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<http://jssidoi.org/esc/home>**TEMPORARY FACTORS THAT CONDITION INNOVATION: COMPARISON BETWEEN FAMILY AND NON-FAMILY BUSINESSES**Pedro Núñez-Cacho ¹, Daniel Lorenzo ²¹University of Jaén, Campus Las Lagunillas, s/n, 23071, Jaen, Spain²University of Cádiz, Avenida Enrique Villegas Vélez, n° 2 11002, Cádiz, SpainE-mails: ¹pnunez@ujaen.es; ²daniel.lorenzo@uca.es

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Abstract. Studies conducted on innovation in family businesses have offered very diverse and sometimes contradictory results. The objective of this paper is to analyze the influence of time-related variables on the innovative behavior of companies. Furthermore, we compare the behavior of family and non-family companies, the influence of the generation and the transference of management. To do this, companies are classified according to the stage of life in which they are and are compared using a mean difference test (Anova). Subsequently, already focused on family businesses, the effects of generating control in the case of family businesses are analyzed, considering the foundational and subsequent periods. The results show that the behavior towards the innovation of family businesses is conditioned by the temporal dimension.

Keywords: innovation; time; family businesses; entrepreneurship

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JEL Classifications: M10, L21, L22, L26

1. Introduction

The family-owned nature of the firm influences the processes of innovation (De Massis, Frattini and Lichtenthaler, 2013). Regarding the innovative orientation of family firms, there are two different streams in the literature. On one hand, family firms are developed from the entrepreneurial spirit of the founder, trying to maintain this entrepreneurial impulse across generations (Casillas, Moreno, and Barbero, 2011; Eddleston, Kellermanns, and Zellweger, 2012; Zellweger, Nason, and Nordqvist, 2012). On the other hand, some authors argue that family firms are not willing to afford risks and become more conservative along the time (Naldi *et al.*, 2007; Zahra, 2005). De Massis, Kotlar, Chua and Chrisman (2014) point that there is no clear evidence about the innovative behavior of family firms. Previous research offers mixed results that can be explained by measurement

factors (Rutherford, Kuratko and Holt, 2008), or by means of missing mediators or moderators behavior (De Massis, Chirico, Kotlar and Naldi, 2014).

Proactiveness is an important feature of family firms' innovative behavior, as well as a key source of sustained growth and performance for family firms (Casillas, Moreno and Barbero, 2010). Entrepreneurial spirit within family businesses may be crucial because its main goal is to identify and gain opportunities, in the dynamic and uncertain competitive environment (Sirmon and Hitt, 2003). Family firms have to face the challenge of surviving in the long run while, maintaining their distinctive features and the innovation can be a way to achieve the goals of family firms. According to Aronoff (1998) family businesses, which feature a long tradition of entrepreneurship, have an advantage in the transition over time.

Innovation is constantly improving: new techniques and methods appear and every day more qualified personnel involved. Innovation processes can start with the recognition of entrepreneurial opportunities, followed by the entrepreneurial actions of exploration and exploitation of the entrepreneurial opportunity. Following Goel and Jones (2016) the firm can opt for two actions, or a combination of them –ambidexterity-, to deal with entrepreneurial opportunities. Ambidexterity changes over time in family firms, so it is so important to consider the temporal dimension in the research of family firms (Sharma, Salvato, and Reay, 2014).

According to Zellweger and Sieger (2012), the proactive attitude of family firms may change over time, so it can be expected differences in the innovative behavior in family firms over time. But, how about non-family firms? Can be expected differences in the innovative behavior among family firms and non-family firms over time? Do they evolve following different paths over time? Maybe age of the firm the main a determinant factor of the evolution of its innovative behavior? Are other factors such as sustainability the reasons of this behavior, or it could be determined by their family or non-family nature? We try to shed some light about these research questions in our study.

The above arguments show a relevant aspect, which presents a lack of research about it. Despite some previous works (Zellweger and Sieger, 2012; De Massis et al. 2014a), the temporary dimension and its influence on the innovate behaviour in family firms is a topic that remains understudied. Therefore the aim of this paper is to analyze the effect of time on the innovation behaviour of the business, and the study of the different effects of it on family firms and non-family firms. To do so, we focus on the different stages of firms, distinguishing between first and later generations of family firms, so considering a temporal distinction for non-family firms. This is useful for the study of family companies, as stated Rau, Werner & Schell, 2018. In addition, the effects on the innovative behavior of companies both of age and of generation in control are analyzed. It contributes to the development of knowledge about family businesses (Núñez-Cacho & Grande, 2013, 2012)

After this first introductory section, the theoretical framework and hypothesis are addressed. Then, the methodology used and the results of the study are presented, and it ends with the discussion and conclusions.

2. Theoretical framework and hypotheses

2.1 Innovation and family businesses

In order to address the research questions about the influence of time on the innovative behavior of the firms, we draw on both agency theory and stewardship theory. According to De Massis et al. (2014a), innovative behavior in family firms can be explained from both an agency and stewardship perspectives. Previous works have focused on the overlapping field that is common to entrepreneurship and family business (Habbershon and Pistrui, 2002; Aldrich and Cliff, 2003; Rogoff, Kay and Heck, 2003; Anderson, Jack and Dodd, 2005; Nordqvist and Melin, 2010) to analyse the entrepreneurial features of family firms that can foster the innovation (Lorenzo and Núñez-Cacho, 2012).

In addition, Corbetta and Salvato (2004) suggested that the innovative behavior depends on the agency-oriented or the stewardship-oriented behaviors between family members and firm managers and owners, that in turn, depends on the nature of family dynamics. These behaviors can evolve over time, from a more stewardship-oriented trend at the early stages of development of the firm, to a more agency orientation in the following stages of life cycle (De Massis, et al. 2014a). The study of the family business has been supported by very diverse theories, which have generally been "borrowed and not returned" to other sister disciplines. Therefore, as we have seen in previous sections, when we reflect on the theoretical framework for the study of family businesses, we find a broad group of theories, many of them complementary to each other (agency-stewardship; agency-resources and capabilities; resources and capabilities-systems etc.) and mostly from the field of organization, psychology, economics and law. Besides, an experience such as succession in the company is rooted in the company's culture (Rau et al. 2018) can condition innovation. Stewardship theory approaches can improve innovation in family businesses and not in family businesses (Neubaum, Thomas, Dibrell and Craig, 2017).

The literature of family businesses takes into consideration two different perspectives (Casillas et al., 2011; Chirico, Sirmon, Sciascia and Mazzola, 2011). On one hand, some authors suggest that family firms feature unique conditions to develop an entrepreneurial path (Núñez-Cacho et al. 2018). On the other hand, other papers point to a more conservative and risk averse profile of family firms (Zahra, 2005; Naldi, Nordqvist, Sjöberg and Wiklund, 2007). There are mixed results about the entrepreneurial or conservative nature of family firms, remaining unanswered the question about the real orientation of family firms towards innovation. Chirico et al. (2011) suggest that it is possible that neither of these two perspectives is fully correct. Perhaps it can be owed to the multiple differences among family firms in terms of openness to change, degree of generational involvement and participation of family members or family employees in the formulation of the strategy. Therefore, the research on innovation in family businesses is inconclusive, although of crucial relevance because of the strong influence of innovation on the firm's performance, growth, and survival (Beck et al., 2011).

2.2 Time and Innovation

Within this research domain, entrepreneurial orientation (EO) has become a well-established construct (Nordqvist and Melin, 2010; Zellweger and Sieger, 2012). EO is referred to "the need for organisations to develop and orientation that allows their individuals and teams to engage in entrepreneurial strategy making" (Nordqvist and Melin, 2010; p. 226), explained by Chirico et al. (2011) as the tendency toward product innovation, proactiveness and risk-taking behaviors.

There are considerations of the time and innovation in the family firms proposed in the literature. Thus, regarding the models that proposed that the family effect has a dual effect that is different for input versus output (Matzler et al., 2015; Lichtenthaler and Muethel, 2012), we could observe the temporality in these kind of studies, they analyse firstly input (initial stage) and after output (final stage). Besides, the models of Duran, Kammerlander, van Essen and Zellweger (2014) and Cucculelli, Le Breton-Miller and Miller (2016) explained that the different behaviour of family firms on innovation was caused by a temporary aspect: The generation in charge. On the other hand, König, et al. (2013) stated that family influence is related with the speed of discontinuous technology adoption that is an accumulated function conditioned by three aspects. Firstly, by the time that incumbents take to recognize the innovation as a relevant strategic issue that requires a response (Kaplan et al., 2003), secondly by the time that incumbents decide to adopt the discontinuous technology (Christensen, 1997), and thirdly by the time that incumbents implement the adoption decision by launching a first product based on the new technology (Lieberman & Montgomery, 1988). Because the respective duration of each of these three adoption phases (Thomas et al., 1993) is not equally affected by each adoption barrier, we discuss the impact of family influence on each of the phases separately. Finally, Carnes et al. (2017) also explain the importance effect of time, highlighting that to innovate is a challenging yet necessary activity for firms throughout their life-cycle to maintain growth over time (Hess, 2007; Hitt et al., 2006).

The EO can be stated to capture a firm's entrepreneurial behavior through innovation, proactivity and risk-taking (Basco et al. 2019). Product innovation refers to the launching of new products to attend the needs of current or future costumers, by using creativity; proactiveness is related to with anticipation in the markets; and risk-taking behavior reflects an entrepreneurial orientation facing decisions that involve a relevant bet for the firm. These three original dimensions of EO have been extended by Lumpkin and Dess (1996), who added autonomy and competitive aggressiveness. Autonomy concerns to the independent action of an individual or a team in bringing forth an idea or a vision and carrying it through to completion (Lumpkin and Dess, 1996), whereas competitive aggressiveness is referred to a firm's propensity to challenge its competitors (Lumpkin and Dess, 1996; Zellweger and Sieger, 2012). De Massis, Chirico, Kotlar and Naldi (2014) focus on proactiveness, as a relevant trait of entrepreneurial behavior in family firms and a crucial source for growth (Casillas, et al., 2010), to analyze its relationship with firm age. They conclude that proactiveness in family firms first declines, then increases, and finally decreases over time.

The time has been considered in studies of FBs analyzing the generation in control, this is the generation that has the control over the management of the family firm (Bammens, Voordeckers, & Van Gils, 2008; Cruz & Nordqvist, 2010). Beck et al. (2011) analyzed the influence of the generation in control on innovation in family firms, previously studied also by Litz & Kleysen (2001), Lorenzo-Gómez & Núñez-Cacho, (2012) and Zahra (2005) and conclude that this relationship is mediated by market orientation. Therefore, the role of the generation in control need to be taken into consideration, because introduces heterogeneity into family firms (Kellermanns & Eddleston, 2006; Kellermanns et al., 2008). This heterogeneity is derived from the evolving features of the family firm's management and structure as the company passes on from one generation to the next (Lansberg, 1999).

Regarding to the differences between family firms of first-generation and later-generation, they were previously studied by Rau et al. (2018). These authors highlighted that the differences between generations include features such as decision-making structure, professionalization degree, attitude against risk, external orientation and orientation towards growth (Beck et al., 2011). The decision-making processes are dependent on the dispersion extent of managerial control among family members (De Massis et al., 2014a). The decision-making structure is more centralized and the level of professionalization is usually lower in first-generation family firms rather than later-generation family firms, as a consequence of the strong influence of the founder in the early periods of the company (Cruz & Nordqvist, 2010; Dyer, 1988). Besides, Zahra, Hayton and Salvato (2004) analyzed risk aversion in family firms, concluding that later generation family firms are more averse to risk than first generation family firms. In addition of it, later generation family firms present a more external orientation than early step family firms that are more internally focused (Cruz & Nordqvist, 2007). Finally, later-generation family firms are more oriented to growth (Kellermanns & Eddleston, 2006), because of the need for growth to ensure the survival of the firm (McConaughy and Philips, 1999). Thus, family firms need to maintain and enhance their innovation capabilities in order to ensure the trans-generational survival of the firm (Beck et al., 2011).

Other justification to these differences in the research is highlighted by Duran et al. (2016) stated that the difference on results on innovation output in family firms with later generation as opposed to first-generation CEOs, arguing that those dynamic capabilities cannot be acquired at short-term, because they need to be built up over an extended period of time. So, innovation processes are conditioned by the time, because it is the only way to acquire dynamic capabilities (Teece, Pisano and Shuen, 1997). As such, the authors also draw attention to the temporal perspective of firms' competitive advantages with regard to innovation, which might cumulate over time.

In addition to this, Werner, Schröder and Chlosta (2017) argue that the companies are conditioned by the time that they spend in the integration in the environment (Aldrich and Cliff, 2003; Bird and Wennberg, 2014). The enduring occupation of the family owner leads to networks of trust with clients and suppliers as potential partners

in R & D cooperation (Habbershon and Williams, 1999). Trusted cooperation along the value chain illustrates the strong networks of SMEs, specifically traditional and old family businesses (Llach and Nordqvist, 2010).

Following Schumpeter (1934), it could be said that innovation is influenced by the way in which a firm manages its resources over time and develops its capabilities. In family firms, the management and structure of the firm of resources and capabilities is performed by the generation in control (Lansberg, 1999), that in turn influences on the innovation of the firm (Beck et al., 2011).

Hypotheses

The specific characteristics of family businesses can contribute to the maintenance of their entrepreneurial orientation over time. Thus, Zahra (2005) points that family firms present a more innovation-oriented culture when the later generations are involved at the helm of the firm. If we consider that family businesses management is transferred from generation to generation, by means of renewal processes that imply a broad tenure which can be extended for a generation -about 25-30 years-, family businesses can respond in a better way to the challenge of reinventing themselves that companies which just have to face this matter from time to time. The replacement of a person in charge of the family business management, which is usually at the end of his professional life, by a person of the next generation, implies a renewal in the direction, changing an elder person for someone younger, with most of his/her professional life ahead. Next generations are often characterized as the drivers behind innovation as well as the identifiers of entrepreneurial opportunities, in searching of new ways of doing things (Beck et al., 2011). The lower demand for results of the family business, characterized by shareholders committed to the long term, what has been called patient capital, facilitates this process of transition between generations, and allows new family members in charge to develop their own way of managing, and at the same time the renewal of the business model and keeping the company in the hands of the family. Because of the changing environmental conditions, next generations have to develop a more external orientation (Cruz & Nordqvist, 2010). Other example is Rau et al (2018), highlighting that with a growing number of generation, innovation output in family firms continuously decrease.

It could be asked if can be expected differences between generations in terms of attitude towards innovation. The founder, in the first generation, is an entrepreneur who sets up a business idea that over time and with his effort can lead to the consolidation of his/her company. In this early step, the concentrated decision-making authority of the founder (Dyer, 1988), may lead to a negative influence on innovation (Beck et al., 2011).

The next generation can inherit a consolidated company, with a business model that has worked properly during a long period, which could coincide with the founder's tenure. However, after a few years, the initial idea will need a renewal to maintain the competitive pulse of the company. On the other hand, the next generation does not have to be a clone of the founder and possibly have their own ideas to reorient the business model of the company. The participative involvement of family members in decision making, in the second or upper generation family firm facilitates innovation (Aronoff, 1998). In addition, the succeeding generations usually receive a higher level of education compared to their predecessors. This greater and better training, regarding to not only the academic field, but also the external work experience in other companies, that they have received as part of the training of successors, could provide the necessary ideas for the renewal of the business model. Also, second or more generation family firms tend to be more professionalized than first-generation family firms (Dyer, 1988).

The sharing of decision making, the higher degree of professionalization, and the higher level of training lead to a higher level of innovation in later-generation family firms. Beck et al. (2011; 256) indicate that "later-generation family firms must rejuvenate, recreate, and reinvent themselves if they want to sustain the same level of growth and financial inheritance of the previous generation". In a similar way, Kellermanns et al. (2008) highlight the

priority on business growth that later-generation family firms must foster in order to ensure the survival of the firm. As a consequence, growth and survival are crucial goals for family firms as a means to allow the transition to the next generations (Kellermanns et al., 2008; Beck et al., 2011) that lead to the reinforcement of innovation.

In this sense, it could be considered that family businesses feature a greater innovative character, both in their beginnings, which can be comparatively similar to those of non-family companies, and in the continuity over the succeeding generations. The need for innovation can be favored by the renewal of leaders at the head of the company, that come from a different generation, by replacing older people with younger people, which may hold better training. One might wonder whether differences in the innovative nature of the company in different generations should be expected. So that, is the family business in the first generation more innovative by the creative impulse of the founder? Or, on the contrary, is it more innovative in the following generations, thanks to the renewing impulse provided by the successors? And if so, could it be considered more innovative the family businesses than non-family ones, which go through renovation processes in a different direction and ownership?

Relief in the management of non-family companies occurs more frequently than in the case of family businesses, whose tenures tend to be more extended over time. That is, family managers may have more possibilities to develop their ideas, more time and a more appropriate context to implement them, because of the family support and non-dependence on short-term results. Possibly managers of non-family companies are more afraid of risking their managerial position by experimenting new business options. This situation may be repeated over time, since the demand for short-term results may not allow to set long-term stable objectives, and ultimately the renewal of the business model on a basis strong enough to build competitive advantages in the long term. In addition of it, the passage of time puts at risk the survival of the company, which will only succeed if it is able to renew itself and maintain its competitive capacity over time (Beck et al., 2011). In this way, it can be considered that seniority influences its innovative capacity, so we can expect differences between younger and longer-lived companies in this regard.

Family firm, due to a mix of long-term orientation, unique resources and capabilities through the interaction of family and business systems makes their behavior different from that of a non-family business throughout their product / market cycle life (Sharma and Salvato, 2011). Patel and Fiet (2011) point that family firms can take advantage of the accumulation of knowledge assets and networks along their trajectories, in order to discovering and exploiting business opportunities. They argue that this kind of family specific resources allow family firms to develop incremental innovations in a more efficient way than non-family firms (Rojas et al. 2017). As a consequence, we propose the next hypothesis:

H₁: In a static temporal analysis, family businesses are more innovation-oriented than non-family businesses

H_{1a}: Family businesses in their first stage of life (0 to 30 years) are more innovative than non-family businesses

H_{1b}: Family businesses in their second stage of life (30 to 60) are more innovative than non-family businesses

Family businesses could be expected to benefit from their specific characteristics over time, and therefore it can be formulated that older family businesses can be more innovative, by transmitting the generational legacy in terms of experience and knowledge. In this sense, this influence of the time factor could be more prominent in the case of family businesses, in comparison with non-family businesses, since the specific characteristics of the family business can favor its innovative capacity over time (Beck et al, 2011; Kellermanns et al., 2008). Also the

Stewardship orientation could enhance the innovative behavior of family businesses, more than non-family (Rau et al. 2018).

On the other hand, the innovative impulse of the company derived from the entrepreneurial character of its founders can be lost, especially in the case of family businesses that can become more conservative over time (Zahra, 2005; Naldi et al., 2007). Business models do not last forever, and the life cycles of the sectors advance in their different stages faster and faster. There is some evidence regarding the average life of companies that hardly exceeds one generation, as revealed by studies in Spain that show an average firm age of 12 years versus 33 years in the case of family firms (Corona, 2015).

De Massis et al. (2016) analyzed some long-lasting innovative family firms to illustrate how the past should be considered as an opportunity to discover knowledge that can be transformed into new products. In this way, past knowledge can be a source of competitive advantages, through the reutilization of existing knowledge within the family and the firm as a basis to innovation. Innovative family firms have special capabilities to leverage tradition in order to develop successful new products and services (Rojas, Lorenzo, and Núñez-Cacho, 2017). Tradition refers to the stock of knowledge, competencies, materials, manufacturing processes, signs, values and beliefs pertaining to the past. De Massis et al. explain how family firms can innovate through tradition as a new product innovation strategy. In this way dynastic families use innovation as the long-term strategic capacity and initiate radical innovations and corporate renewal in order to continue to survive. Thus, time will also be a contingent variable that affects the innovation processes, for example in the relationship between exploitation and exploration of entrepreneurial opportunities (Allison, McKenny, and Short, 2014; Röd, 2016). Ambidexterity changes over time in family firms, so it is so important to consider the temporal dimension in organizational studies in general, and in the research of family firms in particular (Sharma et al., 2014). According to these arguments, we propose the following hypothesis:

H₂: The age of firms influences their innovative capacity

Pittino and Visintin (2009) point out that the founders have a greater orientation towards innovation, adopting a more prospective and analytical strategy than the second generation and following companies. The founders have formal and informal power to allocate resources to explore innovative ideas (Zahra, 2005), while the second and subsequent generations adopt a less entrepreneurial strategy, since they are more interested in preserving the company and maximizing its benefits than in the innovative activities, besides not holding power in the absolute form of the founder, although Craig and Moores (2006) argue that the family business can be more innovative in the generations following the first. Also, when the company is immersed in succession processes, the complexity and uncertainty of this stage can lead to a more conservative attitude, as a result of the presence in the management positions of members of two different generations. The influence of the older generation can lead to more conservative strategies (Ensley and Pearson, 2005), so that the inaction of the new leader still in the consolidation phase can be motivated by an inadequate succession process, in which it has been committed errors or that has been closed in false, propitiating a leadership without the necessary capacities to implant the processes of innovation of suitable way. Therefore, the innovative character can be developed in a different way in each generation.

The innovative character of the family business has been analyzed by Craig and Moores (2006), highlighting that family business attaches great importance to innovation as a key component in its strategy, over time, in a sense comparable to the companies that they operate in advanced technology sectors. In their study, Craig and Moores use a longitudinal sample of family businesses, analyzed in two moments with an interval of 10 years of difference and find a relationship that innovation is related to the life cycle of the company, since companies analyzed family members show significantly higher levels of innovation in the early stages of their development.

However, this innovative drive does not disappear over time, as consolidated family businesses seem to attach great importance to innovation management. These results suggest that innovation continues to be of considerable importance for family businesses, even for those operating in sectors considered more traditional.

As a consequence, we formulate as hypotheses:

H₃: The generation that rules the company influences its innovative capacity.

H₄: The presence of the founder influences his innovative capacity

H₅: Companies that have had a generational renewal are more innovative than those that have not.

3. Research method

3.1 Sample and Procedure

A key issue in every study about family firms is the concretion of what a family firm is. It is not a simple issue because of the lack of a clear differentiation between family firms and non-family firms (Astrachan, Klein y Smyrnios, 2002), in a great extent due to the multidimensional features of the family firms (Uhlener, 2002; Litz, 1995). According to Gallo (1995), there is a high consensus in considering the ownership, family involvement and desire of continuity as the defining dimensions of family firms.

To the effects of our study, we consider a firm as a family firm according to the first two conditions: ownership and family involvement. The condition for ownership is that the family has more than 50% of the shares. Although some criteria for family firms, as the definition by the European Family Businesses Group and the Family Business Network (Corona, 2015), could consider a listed firm as a family firm when the family owns 25% of the shares, we ask for at least 50% of the shares because most of the firms (97.4%) of the considered population are small and medium enterprises (Lorenzo and Rojo, 2015). We also ask for family members as managers or directors in order to measure the family involvement. The third condition for a firm to be considered as a family firm, that is the intention of continuity across generations, is measured by a specific question in the survey, by asking directly to the managers for this intention.

The data for this study were collected through online surveys questionnaires. The survey was sent to the manager of each company, who were contacted by phone. The sample was composed by 1.509 firms. During the period of phone calling were collected 230 responses, thereby was obtained a rate of response of 15.24%. All of them were companies from the region of Andalusia, one of the largest regions in Spain, with more than 8.5 million of people population.

The firms of the sample were taken from the database SABI. In order to select family businesses, we utilize the criteria mentioned in the theoretical framework section, about family ownership and presence of family members in management or government (or both) of the firm. We also ask the sample's firm about their self-consideration as a family firm. Besides, it were included several questions about the family character in the questionnaire. The sample was finally composed by 155 family businesses and 75 nonfamily businesses that in turn were divided into four different groups: family businesses in first generation, family businesses in second or upper generation, non-family businesses with less than 30 years of age, and non-family businesses with more than 30 years after their establishment in line with Gallo (1995).

3.2 Measures

Dependent variable: Innovation. This variable has been assessed using the scale of Beck et al. (2011). It has been also used in the works of Cooper et al. (1994). Research has supported its construct validity. The scale was composed by 5 items ranged from 1 “totally disagree” to 5 “totally agree”. Cronbach alpha coefficient were 0.893.

Independent variables: Family character; Generational period. We classified the companies according to the answers to five questions about the family character included in the questionnaire. We also divided the companies of the sample by following a second criterion that is the age of the company. In the case of family firms, we consider those that are in first generation as a group and those that are in second or upper generations as another group. In order to introduce the time variable in non-family firms, we divided the sample into two different groups, depending of the age of the company was less or more than 30 years. By doing so, we could compare family firms versus non-family firms in different stages of evolution. Generation in control. To determine the generation in control we relied on data obtained from questionnaire. The CEO of the company indicated the number of the generation which is managing the firm (Rau et al. 2018; Bammens et al., 2008). This variable had 5 possible values, from 1 for first generation, to 5 for fifth and later generations.

Presence of the company founder. This variable was measured according the indication of the CEO that was asked about if the founder were controlling the company. The age of the company was measure through the variable “age of the company” taken from SABI database. The age is calculated as the difference between the year of the foundation of the firm and 2017. The variable existence of generational change was measure by asking to the interviewed about the existence of generational change in the company, giving four choices: without changes, first change, second change, third change and others.

3.3 Results of the analysis of variance

To determine if there are statistically significant differences between the means of two or more independent groups, you can use a one-way analysis of variance (ANOVA). First, this analysis has been used to check whether there are significant differences between family businesses and non-family businesses. Second, the Anova analysis has been used to determine if there are significant differences between the four different groups of companies that have been determined. Third, it has been used to determine net differences between the groups in terms of generation, generational change, presence of the founder in the management of the company and seniority.

Since the samples of all the groups do not have the same size, being therefore an "unbalanced" design, we have carefully analyzed the existence of any violation of the assumptions about the validity of the ANOVA test, about normality, continuity of the variables, independent categorical variables formed by two or more groups, independence of the observations. In addition, the Tukey tests were used to confirm that the differences detected through the Anova were significant, an adequate method for this type of samples of unequal size.

Regarding the presence of outliers, there were no outliers in the data, as assessed by inspection of a boxplot. Normality of the data (by observing the form of the distribution of each of the groups) and they was homogeneous, assessed by Levene's test of equality of variances ($p = .120$).

Once it has been verified that the data verify the necessary assumptions, they were analyzed. The Anova analysis propose:

$$H_0: \text{all group population means are equal (i.e., } \mu_1 = \mu_2 = \mu_3 = \dots = \mu_k)$$

If the Anova one way analysis allows us to reject the null hypothesis H_0 , after that Tukey's post hoc test is performed to compare the means of all the groups and see which ones are statistically different.

Regarding to the results of the Anova analyzes carried out for each of the hypotheses, the hypothesis one, which compared innovation between group 1, including family businesses and group 2 that included non-family companies, it can be observed that there are no significant differences with respect to innovation between group 1 family businesses and group 2 non-family companies, $F(1, 229) = .294$ $p = .588$. (See table 1). Therefore hypothesis 1 that indicated: Family businesses have greater innovative capacity than non-family companies is discarded (Table 1).

Table 1: ANOVA one-way Innovation / family vs non-family analysis

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.295	1	.295	.294	.588
Within Groups	229.705	229	1.003		
Total	230.000	230			

Source: authors

Next, H_{1a} and H_{1b} hypotheses are analyzed. The first one affirmed that family companies in their different stage of life are more innovative than non-family businesses.

It has been established four groups: 1: Family businesses 0-30 years; 2: Non-family business 0-30 years; 3: Family businesses 30-60 years; 4: Non-family business 30-60.

The Anova test (table 2) highlights that there are statistically significant differences between the four groups, $F(3,220) = 2.680$, $p < .048$ confirming the H_{1a}

Table 2: Analysis ANOVA innovation and age groups of companies.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	8.100	3	2.700	2.680	.048
Within Groups	221.604	220	1.007		
Total	229.704	223			

Source: authors

In order to know what groups are different, it is performed a post hoc analysis using Tukey test (Table 3). The results show that there are not significant differences between group 1 and 2, so the hypothesis H_{1a} is discarded.

Table 3: Post hoc analysis: Tukey test.

Dependent Variable: INNOVACFAC					
	(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.
LSD	1	2	-.02632986	.16739641	.875
		3	.14349208	.17749871	.420
		4	-.55226492*	.23004195	.017
	2	1	.02632986	.16739641	.875
		3	.16982194	.19398378	.382
		4	-.52593506*	.24298810	.032
	3	1	-.14349208	.17749871	.420
		2	-.16982194	.19398378	.382
		4	-.69575700*	.25005489	.006
	4	1	.55226492*	.23004195	.017
		2	.52593506*	.24298810	.032
		3	.69575700*	.25005489	.006

Source: authors

Regarding to H_{1b} there are significant differences between the groups 3 and 4, being the group 4 (non-family companies 30-60 years) more innovative than group 3 (non-family companies 30-60 years), so this hypothesis is rejected. The table 4 shows the differences between the groups.

Table 4: Homogeneous sub sets.

	Type	N	Subset for alpha = 0.05	
			1	2
Tukey B ^{a,b}	3	49	-.1757856	
	1	92	-.0322935	
	2	59	-.0059636	

Means for groups in homogeneous subsets are displayed.

Source: authors

In relation to the second hypothesis, age and innovation, 6 homogenous age groups have been formed, the first comprising the interval from 0 to 10 years, the second from 10 to 20; the third from 20 to 30; the fourth of 30-40; the 5th from 40 to 50 and the sixth from 50 to 60. It was studied the group formed by the whole companies, analyzing if their age conditioned the innovation. Age is measured by 5-year stretches. The results are the following (see Table 5):

Table 5: Anova and seniority of family businesses

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.015	5	1.203	1.208	.306
Within Groups	223.985	225	.995		
Total	230.000	230			

Source: authors

There were no statistically significant differences in innovation between the different age, $F(5, 225) = 1.208$ $p = .306$. So the hypothesis was rejected.

The third hypothesis stated that “the generation that governs the company influences its innovative capacity”. In this case, four groups formed by family businesses were made: 1st, 2nd, 3rd, and 4th and ss. (Table 6).

Table 6: Generation and innovation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.060	3	2.687	2.878	.038
Within Groups	141.884	152	.933		
Total	149.944	155			

Source: authors

The innovation was statistically significantly different for different generations in charge $F(3,152)=2.878$, $p < .0038$. Subsequently, the Turkey test allows us to analyze in detail the differences between the four groups proposed (see Table 7 and Table 8). The differences between the groups are showed in the Table 8. The Post hoc tests indicate that is significant between the companies on first generation and the second ones. It could be observed differences between the companies on first and third generation, and there is no difference between the other groups (2 and 3; 3 and 4; 2and 4; 1 and 4).

Table 7: Tukey test difference innovation vs generation

	(I) generation number	(J) generation number	Mean Difference (I-J)	Std. Error	Sig.
LSD	1	2	-.43763306*	.16729605	.010
		3	-.60105634	.33727347	.077
		4	-.20800160	.69047849	.764
	2	1	.43763306*	.16729605	.010
		3	-.16342328	.34880830	.640
		4	.22963146	.69618560	.742
	3	1	.60105634	.33727347	.077
		2	.16342328	.34880830	.640
		4	.39305474	.75527466	.604
	4	1	.20800160	.69047849	.764
		2	-.22963146	.69618560	.742
		3	-.39305474	.75527466	.604

Source: authors

Table 8: Homogeneous Subsets generations / innovation

	Generation	N	Subset for alpha = 0.05
Tukey B ^{a,b}	1	93	-.2080016
	4	2	.0000000
	2	52	.2296315
	3	9	.3930547

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 6.239.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Source: authors

The fourth hypothesis indicated that the founder's presence influences his innovative capacity. In this case, the Anova test shows the following results (see Table 9):

Table 9: Anova founder presence / innovation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	32.496	39	.833	.823	.754
Within Groups	117.448	116	1.012		
Total	149.944	155			

Source: authors

There were no statistically significant differences in innovation between the groups where the founder was present and the other. $F(39, 116) = .823, p = .754$. Therefore the fourth hypothesis was discarded.

Regarding to the fifth hypothesis, it indicated that the companies that have consummated a generational management transference in the government of the firm are more innovative than those that do not. The groups that were studied were the following: There has been no generational change or transfer of management (1); the management has been transferred but the ownership remains in the hands of the previous generation (2); the management and ownership of the company has been transferred (3) (see Table 10).

Table 10: Transfer / Innovation

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7.206	2	3.603	3.847	.023
Within Groups	142.365	152	.937		
Total	149.571	154			

Source: authors

The innovation was statistically significantly different for different generations in charge $F(3,152) = 3.847, p < .023$. Therefore, there is a different behavior towards innovation in those groups in which a generational change has taken place (see Table 11).

Table 11: Post hoc test transfer / innovation

	(I) Transfer group	Transfer group	Mean Difference (I-J)	Std. Error	Sig.
LSD	1	2	-.509*	.188	.008
		3	-.049	.195	.802
	2	1	.509*	.188	.008
		3	.460*	.225	.043
	3	1	.049	.195	.802
		2	-.460*	.225	.043

Source: authors

In this case, it is observed that the relay and transfer of the company implies different degree of innovation, in particular the Tukey LSD test indicates that the behavior of companies in which there has been no generational change or transfer of management, is statistically significant behavior towards group 2 companies, in which the management has been transferred but ownership remains in the hands of the previous generation (1); those that have been transferred management and ownership of the company (2); and those that have been transferred ownership but not management (3).

4. Discussion

The study of innovation in family businesses has taken us from an initial phase, in which researchers were surprised by the paradoxical results obtained, often contradictory to each other, to a degree of maturity in which are aware that not all family firms behave equally in the face of innovation. Thus, new factors need to be incorporated into the study and that heterogeneity of family firms must be taken into consideration. At this point we have found a factor that can mark the study of innovation in family businesses is time.

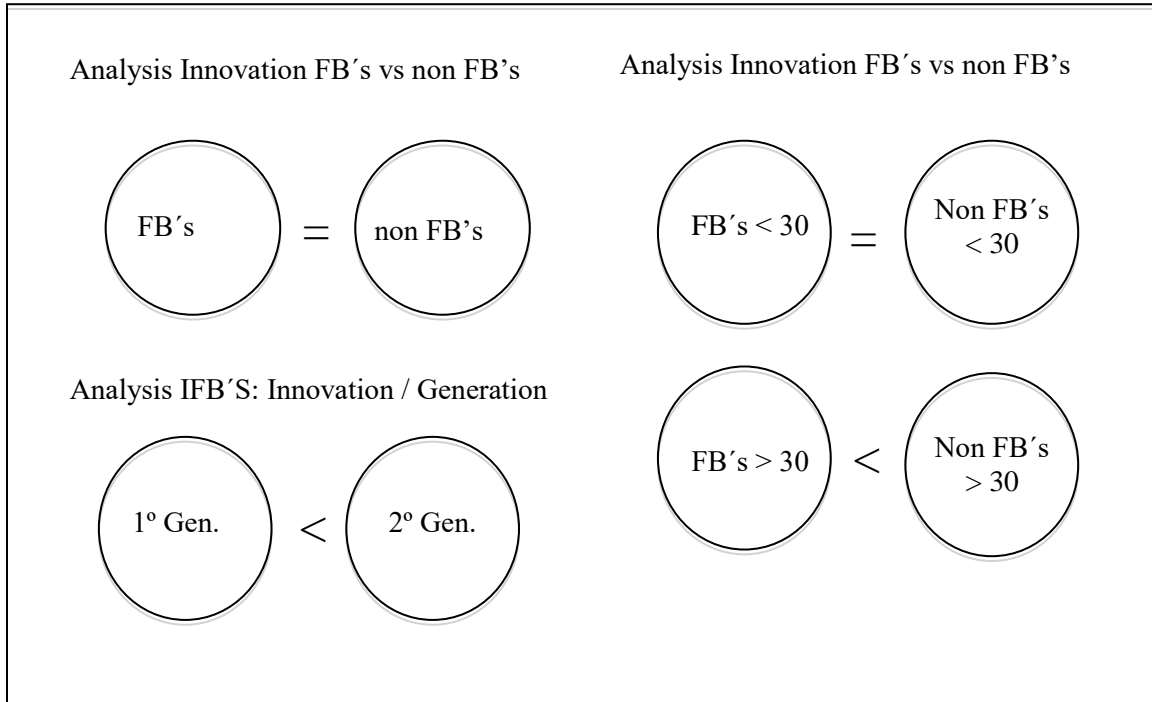


Figure 1: Time and Innovation in family businesses. Comparison of results

The Figure 1 shows that time influences on innovation in two ways, one is the moment to measure the degree of innovation, and another is the moment of life of the company. In relation to the first one, since innovation is a process, if we measure it at the beginning of the process, the innovation in the input that was raised, we will obtain a different result than if we measure it at the end of the process. Similarly, if we measure it when firms are launching a new product we will have a perception of innovation different from if it were measured in the maturity of the product.

On the other hand, innovation behavior is also affected by factors that are derived from the age of the company, transitions or relays in the family business, the generation that is in charge, the presence of the founder of the company. In short, there are a series of factors that condition the results of the study because they cannot be compared with groups with different characteristics.

Our research aims to highlight these differentiating characteristics of the family business before innovation, caused by the variable time. For this reason, we have made two types of comparisons, the first between family and non-family businesses, and the second among family businesses themselves.

The first comparison has been made between the first group, formed only by family businesses and the second group formed by non-family businesses. Well, when performing the analysis without considering any time variable, looking for possible differences between both groups with respect to innovation, the results obtained by the ANOVA test of a factor indicate that there are no significant differences between the means of both groups. This result is in line with other research such as Basco and Calabró (2016). After that, we wanted to introduce a temporary variable to see what results our data offered. This variable could be the generation in control of the company. However, although it was a measurable aspect in family businesses, not in family businesses.

For this reason, we seek a temporary equivalence of the generation, which is also measurable in non-family businesses. The answer was provided by the work of Tapies (2009), which placed the temporal equivalence to a

generational period, around 30 years. For this reason, we group companies assimilating the first generation to the period of 0 to 30 years, and the second generation to the period of 31 to 60 years. In this way, we obtained four groups: the first, family businesses up to 30 years old; the second, non-family businesses up to 30 years old; the third, family businesses with more than 30 years and the fourth, non-family businesses more than 30 years old.

When introducing the time variable, the results of the comparison between groups 1 and 2 show that both family and non-family businesses have a similar behavior in innovation. In other words, there are no significant differences between family businesses and non-family businesses in the early stages of the company's life. However, in the case of older companies, 3 and 4, non-family businesses are more innovative than family businesses. Regardless of other considerations, the results show that when the time variable is introduced in the analysis to discriminate the categories, the results are different from the previous analysis, which was the case of hypothesis 1, in which temporal considerations were not included.

Focused on the results of family businesses, to introduce the temporary nature of these organizations, we use the generation in command. Well, the Anova analysis of differences between the companies of the four generational groups (first, second, third and fourth or greater), showed different behaviors between the groups in innovation. That is, according to the generation in charge in the company, this will be more or less innovative. In the post hoc evaluation of the results, using the Tukey test, we observed that the second generation was the most innovative.

5. Conclusion, limitations and future research lines

In the study of innovation in family businesses, it is necessary to take into account the time variable and the temporal heterogeneity of the companies. As we have seen in the article, heterogeneity is not exclusive to family businesses, also those that are not family businesses, since these also exhibit different innovation behaviors at different stages of life. In this context, the time elapsed since the creation of the company, the generation that is in charge and, specifically, the presence of the founder in it can condition the results of the innovation processes in the case of family businesses.

Therefore, the first contribution of this work to the study of innovation in the family business is that we have to consider the time variable as a critical factor with respect to innovation, both for the time or the life cycle of the company, as for the moment in which we measure innovation.

As a second contribution, it should be noted that the generation in charge conditions the company's behavior in the face of innovation. In this sense, we observe how the second generation is more innovative than the first. We also conclude that there are no significant differences between family businesses and non-family businesses in the early stages, with respect to innovation behavior. It could be that the initial innovative impulse that leads the entrepreneur to create a business does not depend on the family condition of the company. In addition, continuing with the analysis of family businesses, those that have completed the generational change are more innovative than those that have not.

This document has certain limitations. First, the use of questionnaires and small samples to collect information implies the specific limitations that arise from the subjectivity involved in the use of this tool. When questionnaires are used, the researcher does not directly address the phenomenon under study and respondents have a margin of freedom of interpretation that can distort the target set. In addition, respondents' responses may reflect their own prejudices, since many items are based on the respondent's perception.

Another limitation originates in the horizontal nature of the investigation. The information was collected at a given time, with the exception of certain innovation indicators. It would be worth analyzing these relationships

between innovation and independent variables through the use of prolonged periods to isolate temporal phenomena that could distort the result, as we formulate in this article.

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