DO CEO'S DEMOGRAPHIC CHARACTERISTICS AFFECT FAMILY FIRMS' INNOVATION?

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Abstract

The aim of this paper is to consider how CEO's demography affects family firm's innovation. Innovation is a key factor in developing the competitive advantage of family firms in their long run orientation. In this type of firms, CEO is often the most influent individual in the governance of the firm. Thus, investigate his impact on innovation is challenging and relevant. Following the insight from the Upper Echelon Theory (Hambrick and Mason, 1984), we empirically test the impact of the CEO's demography on innovation using a sample of 251 Italian family companies. Specifically, we found that in family firm CEO's education and experience influence innovation, while age does not.

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Keywords*: Innovation; family firm; CEO; Upper Echelon Theory*

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1. Introduction

Due to their long run orientation, innovation is relevant in family businesses (Lumpkin and Brigham, 2011). The main question is the relationship between the presence of the family and its role toward innovation (Craig and Moores, 2006; De Massis et al, 2013; Kellermanns, Eddleston, Sarathy & Murphy, 2012; Kellermanns, Eddleston, Barnett & Pearson, 2008; Kraiczy, Hack & Kellermanns, 2015; Urbinati, Franzò, De Massis and Frattini, 2017). Previous contributions highlight that the family impact on innovation is direct *vis-à-vis* input (Chen and Hsu; 2009; Block, 2012; Chrisman and Patel, 2012), outcomes (Pittino and Visitin, 2009; Llach and Nordqvist, 2010) or activities (Classen, Van Gils, Bammens and Carree, 2012). The aim of this paper is to identify, at individual level, the driving factors of the innovation capacity in family firms. As such, the role of the CEO's characteristics will be investigated.

CEO in family firms (usually the founder or a family member) assumes a primary role as the single decision maker (Bennedsen, Nielsen, Pérez-González and Wolfenzon, 2007; Feltham, Feltham, & Barnett, 2005; Zellweger, Kellermanns, Chrisman and Chua, 2012; Basco, 2013). As a single decision maker, CEO plays a central role in the promotion of firm's performance (Miller, Le Breton-Miller, Minichilli, Corbetta and Pittino, 2014), entrepreneurship (Zahra, Neubaum, & Huse, 2000) and innovation (Kellermanns et al., 2008; Sanchez-Famoso, Maseda, and Iturralde, 2017). However, the question about how the characteristics of family firm CEOs affect innovation has been rather under-researched within the existing scholarly work on innovation in family firms (D'Allura, 2019). Therefore, adopting the Upper Echelons Theory of Hambrick and Mason (1984), we focus our analysis on CEO's demographic characteristics (i.e. age, education and experience) testing whether such qualities, proxies of his/her decisional orientation, impact on the innovation output of family firms.

A complete understanding of the attitude of the CEO is necessary because family firms tend, in order to protect the firm over the long run, to be conservative and to minimize innovation. Thus, we consider that the impact of individual family members, such as the CEO in the family firm may be critical to innovation behavior and to the long run firm's success. In terms of management innovation, King and Anderson (1995) further characterize innovation output as the result of intentional rather than accidental actions which must be distinguished from routine changes (Cesaroni and Sentuti 2016). As such we follow the intentional process path in considering the key role that the top executive plays inside the firm (Hambrick, 2007; Heyden, Reimer and Van Doorn, 2017).

The paper is structured as follows. First, we introduce the upper echelons theoretical perspective in order to develop our hypotheses based on

the influence of age, education and experience. Second, we conduct an empirical analysis based on a sample of 251 Italian family firms. Third, we discuss the managerial and policy implication and finally we conclude with limitation and future development.

2. Theoretical background and hypotheses: The Upper Echelon Theory

The seminal work of Hambrick and Mason (1984) illustrates how, in the presence of complex information and uncertain situations, managerial choices are not objectively predictable but "merely interpretable". We need to consider which factors are the most effective proxies in order to allow accurate predictions about the choices of top executive. A similar approach is built on the premise of bounded rationality (Simon, 1977). Research based on the Upper Echelons Theory (Hambrick and Mason, 1984) has a long history and many authors examined the association of executive characteristics with organizational decisions and attributes (see e.g. Thomas, 1988; Bantel and Jackson, 1989; Barker and Mueller, 2002).

Our main conjecture is that firm's innovation output will vary significantly depending on its CEO's characteristics, even though firm-level factors are taken into consideration (Howell and Higgins, 1990; Howell and Avolio, 1993). This idea is based on three assumptions. First, we state that innovation is a strategic choice that top executives and, in particular CEO, have the discretion to control (Green 1995). Since innovation represents a long-term investment that is considerably risky with high failure rates (Mansfield 1968), we expect that the CEO monitors innovation closely. Moreover, in the case of family firms, CEO feels responsible for future generations and for the family wealth (Fitz-Koch and Nordqvist, 2017). Second, we assume that CEO in family firms has a significant organizational power to influence innovation as the leader is often the founder or his/her successor and he/she is the central strategic decision maker for the family (Sciascia, Mazzola, and Chirico, 2013). Finally, we assume that a CEO's preferences for innovation are associated with visible characteristics such as age, education and experiences (Bantel and Jackson, 1989).

2.1 CEO Age

In the early literature, Hambrick and Mason (1984), and later MacCrimmon and Wehrung (1986), found that older executives tend to be more conservative and risk- averse (Dechow and Sloan, 1991). Moreover, citing learning theory (e.g., Chown 1960), Hambrick and Mason (1984) suggested that older leaders may have greater difficulty grasping new ideas and learning new behaviors. In fact, older CEOs may be less inclined to in-

vest because they have different incentives than younger ones (Barker and Mueller, 2002). This behavior is also related to the differing motivation and list of priorities of younger when compared to older CEOs. With age, individuals need to reflect longer and take more time to act, all of which could diminish innovation output effectiveness as this typically requires swift decisions (Burke and Light 1981). An older CEO may also have less desire for innovation, because he/she prefers to retain his/her current status whereas a younger CEO may want to improve the firms' results to boost his/her career. Therefore, he/she would tend to invest more in innovation (Barker and Mueller, 2002). Older managers may also lack the stamina to endure the constant stress and challenges of technological change. Being at a stage in their life in which stability and job security is particularly important, they may be less willing to take risks (Hambrick and Mason 1984). Consolidating this idea, cognitive theorists suggest that some learning abilities and energy decline with age (Burke and Light 1981). Consequently, older managers may not be able to evaluate new ideas quickly and thus may tend to avoid including new ideas in their decisions.

Therefore, we developed the following hypothesis:

HP 1: The age of a family firm's CEO is negatively related to the level of innovation.

2.2 CEO Education

The educational level of CEO has been in the focus of academic investigation for long time. Hitt and Tyler (1991) and then Wally and Baum (1994) have found that highly educated executives have greater cognitive complexity that provides greater ability to absorb new ideas and therefore to increase innovations (Bantel and Jackson, 1989). Other studies go further and analyse the impacts of different types of education on innovation (see e.g. Finkelstein and Hambrick, 1996; Barker and Mueller, 2002). For example, CEOs who hold a degree in a technical field spend more on R&D than CEOs with educational backgrounds in business or law. Moreover, CEOs with graduate degrees have a greater capacity to process information and are more receptive to change (Wiersema and Bantel, 1992; Wally and Baum,1994).

In the case of family firms, scholars suggest that the desire to protect family wealth and prospects for future generations leads family firms to avoid the risk of introducing external expertise. Instead, they only weakly integrate competent external employees (Vinton, 1998). According to Gomez-Mejia, Cruz, Berrone and De Castro (2011), hiring outside managers, delegating authority to them, and relying on a command structure independent from the family are all likely to decrease family control over

strategic decisions such as innovation ones. Thus, the lack of professionalism in family businesses may impede innovativeness and delay or prevent change (Chirico and Nordqvist, 2010; Salvato, Chirico, and Sharma, 2010). But not all the family businesses adopt the same choice in terms of professionalization and the literature has also emphasized differences in the professionalization process between family and nonfamily firms. In this direction, we seek to advance this debate by testing how family firms that decide to manage their resource differently may be more innovative. We focus on the case in which the family businesses hire or select among the family members a highly educated CEO and we want to test how this influences the level of innovativeness.

Thus, our second hypothesis states that:

HP 2: Family firms with highly educated CEO are more innovative.

2.3 CEO Experience

Kirton (1976) suggested that individuals can be positioned on a continuum ranging from those who have an ability to do things "better" to those who have an ability to do things "differently". These abilities are identified as a result of the different solutions such individuals produce to seemingly analogous issues. Neither ability is considered superior *per se*, just different as it reflects two different behavioral patterns between a work environment style (i.e. doing things better) and a problem-solving style (i.e. doing things differently) (Payne, Lane and Jabri, 1990). Innovative behavior is more closely related to the second attitude. We consider that, together with the attitude, the individual path of the CEO is relevant to those aspects and is allegedly influenced by matured experience (Sciascia, Mazzola, and Chirico, 2013). Being a member of another board creates the opportunity to see things differently from the family-firm style and subsequently, increases the ability to do things differently. The same applies to experience abroad. CEOs who have had experience in other countries and collaborated with foreign colleagues should be more receptive to new ideas and to broader views. CEOs with past experience may have discovered new solutions as well as new managerial styles. In fact, in order to do things differently (and then be more innovative), it is crucial to change perspective (Pinelli, Franco and Peruffo, 2018). Instead, staying inside the family or employment boundaries and considering exclusively the first-generation point of view, lessens the ability for future generations to do things differently.

Based on those evidences, we hypothesize that:

HP3: Family firms with experienced CEOs are more innovative.

3. Empirical setting

3.1 The Econometric Model

In order to verify the existence of different impacts of CEO demographic characteristics on innovation output we analyzed a sample of family firms (i.e. firms at least 20% owned by a family) (Cascino, Pugliese, Mussolino and Sansone, 2010). The estimated model assesses the impact of CEO attitude on the firm's innovation output, monitoring for firm-specific effects. This is estimated by an ordinary least squares given the continuous nature of the dependent variable (Green, 1995).

A model is implemented:

Innovation = fn (Age, Education, Experience, Family member, Control variables)

3.2 The dependent and independent variables

Innovation has been investigated by several scholars and it can be measured both as concern input (e.g. investment in R&D) or output aspects (e.g. patents). Schumpeter (1911) argued that anyone seeking profit must innovate and subsequently differentiated five categories of innovation: new products, new production methods, new markets, new supply sources of raw materials and semi-finished goods, and new industry structures. Thompson (1965), on the other hand, referred to innovation as the generation, adoption, and implementation of new ideas, internal processes, and products or services. Other scholars have defined innovation as all activities devoted to the conception, design, manufacture and introduction of a new product, service, or process (Burgelman, Kosnik, and van den Pol, 1988). One definition that stands out as the most exhaustive is the West and Farr's definition (1989): "[innovation is the] intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit role performance, the group, the organization or the wider society". In our vision we refer to innovation output and, coherently to this definition, the dependent variable for the proposed model is (variable *Innovation*) measured as the logarithm of the number of patent applications.

The demographic variables of the CEO are identified based on Carpenter, Geletkanycz and Sanders (2004) and are reported in the first part of Table 1. *Age* is a dummy variable equal to 1 if the age of the CEO is more than 50 years, zero otherwise. *Education* is a dummy variable equal to 1 if the CEO has at a minimum, graduated, zero otherwise. *Experience* is another

dummy variable equal to 1 if the CEO had a foreign experience and/or took part in another top management team, zero otherwise. Finally, *Family member* is a dummy variable equal to 1 if the CEO is a family member and 0 otherwise.

Firm-specific variables are included in the analysis as control variables. As previously stated, the literature demonstrates that firms have a heterogeneous attitude towards innovation, leading to several studies aimed at identifying the factors that affect the degree of innovation output. Among other variables, we include the following firms' characteristics: size, age, internationalization, financial constraints, profitability, geographical localization and industry (e.g., Horstmann, MacDonald and Silviniski, 1985; Arundel and Kabla, 1998; Mansfield, 1986; De Rassenfosse, 2010; Chabchoub and Niosi, 2005).

We include firm size and firm age as control variables, which proxy for accumulated knowledge and experience and usually display a positive correlation with innovation capacity (Brouwer and Kleinknecht, 1999). Firm size (variable *Firm size*) is measured by the logarithm of thousand euros of turnover, whereas the variable *Firm age* is defined as the logarithm of firm age in 2008.

Tab. 1: *Description of the variables employed in the analysis.*

VARIABLE	DEFINITION	SOURCE
	DEPENDENT VARIABLES	
Innovation	Logarithm of number of patents held by the firm (number of patent)	Espacenet
	INDEPENDENT VARIABLES	
	CEO demographic variables	
Age	Dummy variable equal to 1 if the CEO age is more than 50 years, zero otherwise (.)	Linkedin, Borsa Italiana and firm's website
Education	Dummy variable equal to 1 if the CEO is, at least, graduated, zero otherwise (.)	Linkedin, Borsa Italiana and firm's website
Experience	Dummy variable equal to 1 if the CEO made a foreign experience and/or take part to another top management team, zero otherwise (.)	Linkedin, Borsa Italiana and firm's website
Family member	Dummy variable equal to 1 if the CEO is a family member, zero otherwise (.)	AIDA
	Firm Characteristics	
Firm age	Logarithm of firm age (number of years)	AIDA
Firm size	Logarithm of thousand Euros of turnover (Euros)	AIDA
Pavitt scale intensive	Dummy variable if the firm is in a scale dominated industry, zero otherwise (.)	AIDA
Pavitt specialized supplier	Dummy variable if the firm is in a specialized supplier industry, zero otherwise (.)	AIDA
Pavitt science based	Dummy variable if the firm is in a science based industry, zero otherwise (.)	AIDA
Pavitt other	Dummy variable if the firm is in other industry, zero otherwise (.)	AIDA

North	Dummy variable equal to 1 if the firm is in the South of Italy, zero otherwise (.)	AIDA
Profitability and Financial Constraints		
Profitability	Return on investment (%)	AIDA
Financial constraints	Liquidity ratio, calculated as the ratio of bank debt and total assets (.)	AIDA
Internationalisation		
Degree of internationalisation	Logarithm of number of FDIs (number of FDIs)	REPRINT
International age	Number of years of firm presence in the international market through FDI (number of years)	REPRINT

The estimation is upgraded by the inclusion of the firm's international presence via FDIs (foreign direct investments) as they impact on innovation (Nosi, Pucci and Zanni, 2017). The literature suggests that by acting in international markets, firms can better capitalize on the exclusive rents of innovative output. Multinational firms offer products to a larger number of potential buyers, thus enhancing profits based on innovation efforts and spreading innovation costs. Additionally, internationalization lowers the risks that emerge within R&D by avoiding fluctuations and business cycles that are specific to a single market (Kafouros, Buckley, Sharp, and Wang, 2008). Furthermore, international investments enhance a firm's knowledge about the environment and competition in various countries. This knowledge may guide the firm to become involved in the most promising innovative projects (Filippetti, Frenz and Ietto-Gillies, 2009; Balboni, et al., 2016). We proxy international presence through the variable *Degree of internationalisation*, measured as the logarithm of the number of the firm's foreign subsidiaries and the variable *International experience* measured through the number of years of international presence through FDIs.

Firms may be unable to cover the costs of innovation since the effective expenditure may vary due to differences in the availability and cost of financial resources. The firms' financial constraints are represented by the ratio between their bank debt and total assets (variable *Financial constraints*).

The literature documents a higher innovation output in the case of high profitable firms (Hanel and St. Pierre, 2002; Bartolacci, Paolini and Zigiotti, 2016). Specifically, the variable *Profitability* is measured by the ratio between EBITDA and total investments (i.e., the return on investments).

We also monitor the effects of geographical localization. The binary variable *North* takes the value one when the firm is located in the North of Italy, and zero otherwise. Wright, Westhead, and Ucbasaran (2007) and Bannò, Piscitello and Varum (2014), discuss how context may impact a firm's performance and strategy, due to policy incentives or institutional context.

Finally, we include industry dummies as further controls not only because of the significant impact of the industry on innovation capacity

(Scherer, 1983), but also because patenting is more extensively used as an intellectual-property protection tool in science-based industries. The analysis monitored the industry by using the Pavitt taxonomy (1984). Four binary variables identify whether the firm belongs to a traditional sector, a scale-intensive sector, a specialized supplier sector, a science-based sector or any other sector (the variables are *Pavitt traditional*, *Pavitt scale intensive*, *Pavitt specialised supplier, Pavitt science based* and *Pavitt other*, respectively).

We express all continuous independent variables as logs both to decrease the impact of outliers and to reduce heteroscedasticity.

Table 1 reports the definitions of both the dependent and independent variables in the proposed empirical analyses.

3.3 Data and Sample

The empirical sample used to investigate the impact of CEO demographic characteristics on the firm's capacity to innovate, consists of 251 Italian family companies randomly selected.

Innovation output is measured by the logarithm of the number of patent applications that were obtained from the Espacenet database, which provides information covering approximately 90 million patent documents worldwide, including information about inventions and technical developments dating back from 1836 to today. Espacenet is a free online service for searching patents and patent applications. It was developed in 1988 by the European Patent Office and the member states of the European Patent Organisation. Data on family firms' characteristics (i.e., ownership structure and details about the CEO characteristics) were retrieved from the AIDA (Bureau van Dijk) database. AIDA database records the company name, the year it was founded and the family name of each board member and shareholder with the respective ownership share, thus allowing us to identify kinship relations on the basis of family names. Balance sheet data (i.e., size, age, financial constraints, profitability, industry) were also obtained from the AIDA database (Bureau van Dijk).

Information on firm internationalization, here measured by the number of FDIs and through the international age, has been retrieved from Reprint, which provides a census of Italian outward investments. Reprint classifies FDIs based on the actual location of economic activities. Consequently, we were able to exclude foreign investments made by financial firms, investment funds, private equity funds and merchant banks as part of a management buy-out and when there is no direct participation in the management of the investee company (for additional details, see Mariotti and Mutinelli (2012)). Finally, company data refers to 2008, before the start of the economic and financial crisis. This means that any contingent effects of the economic cycle on our results can be excluded.

4. Results of the Empirical Analysis

Table 2 reports the mean values of the variables that account for the whole sample, in particular CEO demographic and control variables. The average *Innovation* output is equal to 0.70. The CEO's demographic variables show us that the CEOs have mostly received higher education (more than 73% have successfully completed a university degree) and have had substantial professional experience. Interestingly, the average CEO had gained some international experience and 76% had been on other boards of directors. Across the whole sample the firms are, on average, small and medium ones (75%) and more than 46 years old. They are more concentrated in traditional sectors. Average ROI is over 8%, while financial constraints are not very high. As far as internationalization is concerned, the majority of analyzed firms are multinational.

The regressions to test the research hypothesis via econometric estimates were run using STATA 12.0. The correlation matrix, available upon requests, shows acceptable correlation indexes between all regressors.

To examine multicollinearity, we calculated the variance inflation factor (VIF), which is equal to 1.95, below the rule-of-thumb cut-off of 5. Thus, issues of multicollinearity are not a matter of concern.

The econometric results presented in Table 3 highlight that only some of the CEO's demographic variables included as determinants of innovation output have the expected effect and that not all the control dimensions have the same impact[1].

[1] As a robustness check, we run two additional models. The first one is a logit regression with a new dependent variable defined as a dummy variable if the firm has patents, and zero otherwise; a GLM model. The second model is anestimation of the main model with the dependent variable logged, since we include most of the independent variables in logs. In all three models the results, which are available on request, are the same.

Tab. 2: *Descriptive statistics of the variables employed in the analysis*

VARIABLE	*MIN*	*MAX*	*PERC./ AVERAGE*	*STD. DEV.*
DEPENDENT VARIABLE				
Innovation	0.00	0.81	0.70	
INDEPENDENT VARIABLES				
CEO demographic variables				
Age	1.41	1.94	1.74	0.10
Education	0	1	73%	0,44
Experience	0	1	78%	0.41
Family member	0	1	65%	0.47
Firm Characteristics				
Firm age	0	2.44	1.53	0.39
Firm size	1.78	7.29	5.00	0.85
Pavitt traditional	0	1	44%	0.37
Pavitt scale intensive	0	1	21%	0.41
Pavitt supplier dominated	0	1	19%	0.39
Pavitt science based	0	1	14%	0.35
North	0	1	85%	0.36
Profitability and Financial Constraints				
Profitability	-28%	40%	8.23%	9.37
Financial constraints	0.00	9.99	34.51	20.11
Internationalisation				
Degree of internationalisation	0	2.61	0.64	0.65
International age	0	2.44	1.53	0.39

Tab. 3: *Empirical results*

	COEFF.	*SIGN.*	*STD. ERR.*
CEO demographic variables			
Age	0.51		0.45
Education	0.30	***	0.11
Experience	0.19	*	0.11
Family member	0.071		0.09
Firm Characteristics			
Firm age	0.22	***	0.09
Firm size	0.07		0.06
Pavitt traditional			
Pavitt scale intensive	-0.24	**	0.12
Pavitt specialised supplier	-0.15		0.52
Pavitt science based	0.24	*	0.14
North	0.08		0.12
Profitability and Financial Constraints			
Profitability	-0.01		0.01
Financial constraints	0.01		0.01
Internationalisation			
Degree of internationalization	0.21	**	0.09
International age	0.39	*	0.11
Observations: 251; R2=0.67			
** Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level*			

The impact of the CEO demographic variable is driven both by education and experience (the coefficient of *Education* and *Experience* are positive and significant respectively at $p<0.01$ and $p<0.10$). Thus, hypothesis 1 is not confirmed, while hypotheses 2 and 3 are confirmed.

The age (i.e., *Age*) is non-significant, albeit positive. In the case of family firms, we argue that age has a different guise. Since all family members, both young and old, are responsible for the family wealth and thus the family's future financial well-being, (Fitz-Koch and Nordqvist, 2017) we argue that age is not necessarily related to innovation capacity. The long-term approach of management embedded in a family business is not linked to a CEO's age but rather to a structural firm feature. First, the defining feature of family firm is the intention to pass the business to successive generations (Chua, Chrisman and Sharma, 1999), implying a long-range view. Second, succession in family firms, according to socioemotional wealth (Gómez-Mejía, Haynes, Nuñez-Nickel, Jacobson and Moyano-Fuentes, 2007) takes non-economic goals such as harmony (Chrisman et al., 2010), integrating

family values into the business system (Handler, 1990) and expressing altruism toward family member employees (Schulze, Lubatkin and Dino, 2003). Considering those features, we argue that young family CEO prefers to follow the tradition of the family and to adopt the choice of the older one to save harmony, to avoid conflict and to preserve family tradition. According to Hibbert and Huxham, (2010) tradition can be defined as the accumulation of know-how, symbolic and cultural content across generations and it contributes to shaping the identity of individuals and organizations. Thus, we consider that in the case of family firm this is a strong micro-foundation of innovation path (De Massis et al., 2016) and this will turn in some constrains on the management of innovation. As such, family tradition shapes the innovation choice and, in case of family business, age is not related to the level of innovation output. Instead, the level of innovation follows the family tradition and cognitive behavior embedded in the family view (De Massis, Frattini, Kotlar, Petruzzelli and Wright, 2016).

Similarly to our interpretation, Kellermanns et al., 2008, did not find a significant relationship of CEO age with entrepreneurial behavior. They concluded that this may be a unique finding for family firms. "[…] Although entrepreneurial behavior in general may be strongly associated with age, it is possible that pressures in family firms may mitigate such an effect. So even if a family firm member becomes a CEO at a young age, he or she may not have the power to enact entrepreneurial behavior […]".

Four of the control variables are significant: *Age*, *Pavitt science-based* sectors, *Degree of internationalization* and *International experience*. Unsurprisingly, there are significant differences between sectors. High technological and science-based opportunity sectors tend to have a higher level of innovation than other sectors (the coefficient of *Pavitt science based* is positive and significant at $p<0.10$). On the contrary, the *Scale intensive sector* shows a negative and significant coefficient at $p<0.05$.

International presence is important because both coefficients of *Degree of internationalisation* and *International experience* are positive and significant at least at $p<0.05$.

Finally, the other coefficients displayed by the control variables show that firm size has no significant effect. Similarly, other firms' structural and balance-sheet data (i.e., *Financial constraints*, *Profitability* and *North*) are not significantly different from zero.

5. Discussion and conclusions

Innovation is necessary and vital for a firm that wants to grow and become more profitable. It is a process of ideas generation and development that requires team work and cooperation among several areas within the

organization that call for a strategic management from the decision makers of the (family) firms. Innovation decisions are risky and require strategic capabilities. Firms' leaders play a crucial role in this process of exploring new paths, using new knowledge, and developing new products and services that may prove successful on the market. Our aim was to provide evidence on the relationship between CEO's characteristics and innovation considering the strategic role that CEOs played as single decision makers. Specifically, we focused on the role of CEOs in family firms as they are a very widespread model of business organization and governance all over the world, including Italy.

CEOs are responsible for several crucial decisions. First of all, CEOs have to analyze and manage the risk of innovation processes. CEOs may also play an important role in integrating formerly segregated departments, help to establish new communication lines and reconcile conflicting interests (Kitchell, 1997). In addition, the CEOs can improve morale and strengthen commitment. A CEO may play the role of transformational leader and foster a change-oriented culture within the firm and by doing so he/she can enable a more risk-taking approach, promote experimentation and introduce a positive handling of mistakes made during the innovation process. Our analysis was based on the assumption that firm's innovation capacity significantly depends on specific CEO's characteristics, instead of considering only firm-level factors. This is the first contribution to the literature. We shed a new light on the governance of innovation by considering the individual level instead of only the organization one. The individual level analysis is advanced for the first time to Hambrick and Mason (1984) when they proposed the Upper Echelons Theory. Accordingly, we assumed that innovation is a strategic choice that (in family firms) CEOs have the discretion to control. Since innovation represents a long-term investment that is considerably risky with high failure rates, we expect that the CEO in family firms monitors innovation closely (Fitz-Koch and Nordqvist, 2017).

Different aspects of the role of CEO in family firms have investigated, but to the best of our knowledge, its relationship to innovation capacity is still underdeveloped. The second contribution of this work goes in this direction. Specifically, we assumed that a CEO's preferences for innovation capacity were associated with his/her age, education and experiences. Our analysis confirms our intuition and we can state that CEOs have an impact on innovation output of family firms.

We found that a higher level of CEOs' education and experience has a positive influence on firms' capacity to innovate whereas CEOs' age seems to have no impact on capacity to innovate in family firms. So, on the one hand, we may maintain that family firms are similar to non-family firms since CEOs' education is one demographic characteristic that matters in the innovation capacity of the firms. On the other hand, CEOs' age, which

reduces innovativeness in non-family firms, does not have the same effect on family firms. Our interpretation of this result is that familiness gives to the firm a long-term orientation which could be innovation-friendly (Duran, Kammerlander, Van Essen and Zellweger, 2016). Moreover, family firms have probably a less hierarchical structure which enables easier team working and cooperation that foster innovation output. These features facilitate innovation in family firms regardless of the CEO's age.

Our results also show that a CEO's accumulated knowledge on the job is also important for the innovation capacity of the firm. The innovation output is higher for those firms which are led by CEOs with experience abroad and/or who are also members of other companies' top management teams. This is an important result because it has far-reaching policy implications. The main conclusion of this result is that a more innovative industry might therefore appreciate managers who have had experience abroad and/or have had a diversified career.

Our study contributes to the literature on the governance of innovation in several ways. First, we conclude that the traditional demographic variables exert the same effect also in the specific subsample of family firms except for age. Our interpretation is that the long-term orientation that characterizes family firms prevail over the effect of the risk averse attitude of older CEOs. Second, with our results we contribute to the literature of family business improving our knowledge of the relationship between the governance (i.e. CEO characteristics) and innovation. Third, the use of the Upper Echelons Theory advances our understanding at the individual level and allows us to confirm that family firms are not a homogeneous group (Melin and Nordqvist, 2007). This is further contribution that answer to the call of family business literature to advance our understanding about family firms heterogeneity (Chua, Chrisman, Steier, and Rau, 2012). Our results show that family CEO is not a homogeneous unit of analysis and, based on the insight of Upper Echelons Theory, we showed how the combination of different characteristics of the CEO should support and account for the innovation path of the family firms.

Some implications of our research arise. As the ability to select innovative-enhancing CEOs is very important, we provide evidence that family firms should select her/him carefully. Family firms may be prone to favoritism toward family' members, regardless of their education and experience. Hiring CEOs with appropriate education and with previous relevant experience abroad may strengthen the innovative capacity of the organization. Finally, the succession process in family firms should take into account that education and experience abroad should be part of the training of the younger members of the family, preparing them to become effective, innovative CEOs.

6. Limitations and future research

Some limitations of our results may stem from the fact that the sample is made exclusively of Italian companies. A comparative study would broaden the scope of our analysis, enabling us to take into account country-specific differences. Another limitation comes from the type of information we used. The education variable does not allow to distinguish between different types of degrees (e.g. humanities, business, scientific or technical degrees) held by CEOs. Also, the dependent variable (i.e. Patent) has many limitations in capturing innovation output.

This study could be expanded by examining the effects of CEOs characteristics on R&D spending, as an indicator of innovation input by the firm (Barker and Mueller, 2002). Further development of our research could be the investigation of how diversity in the top management team members' may affect innovation. Functionally diverse teams have a larger pool of experiences, skills and non-overlapping knowledge at their disposal (Simons, Pelled and Smith, 1999) which may have the effect of stimulating innovation and decision-making; however, at the same time, functional diversity might also cause team fragmentation, which may lessen effective functioning of top management team (Hambrick and Mason, 1984). Finally, CEOs demographic characteristics may also impact on the internationalization decisions of family firms: timing, methods of entry, location of FDIs. Further development is suggested also in this direction.

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Riassunto

Lo scopo di questo lavoro è analizzare l'influsso delle caratteristiche demografiche del CEO sull'innovazione delle imprese familiari. L'innovazione è un fattore chiave nello sviluppo del vantaggio competitivo delle imprese familiari nel lungo periodo. Nello specifico, in questa tipologia di impresa, il CEO è spesso il soggetto più influente del governo dell'impresa. Pertanto, investigare il suo influsso sull'innovazione è rilevante, oltra che ricco di sfide, teoriche ed empiriche. Il lavoro trova il suo fondamento teorico nell'Upper Echelon Theory di Hambrick e Mason (1984), e testa empiricamente la relazione esistente tra caratteristiche demografiche del CEO e innovazione in un campione di 251 imprese familiari italiane. Nello specifico, i risultati a cui giungono le analisi rilevano che il livello di formazione e le esperienze del CEO influiscono sull'innovazione, mentre la sua età anagrafica non risulta rilevante.

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