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Inbound, outbound or coupled?

When being a family firm leads to higher innovativeness

Elena Casprini, Tommaso Pucci, Hans Ruediger Kaufmann, Lorenzo Zanni

Abstract: Drawing from the open innovation (OI) and family business literatures, the aim of this study is twofold. First, it distinguishes among inbound, outbound and coupled OI processes and investigates to what extent these OI processes influence a firm's innovativeness, in terms of product, process and organizational innovation. Second, it looks at the impact of being a family firm in moderating these relationships. Based on a unique database on 119 Italian firms, the hypotheses are tested through a hierarchical moderated multiple regression analysis. The results show that inbound and coupled processes positively influence product and process innovation, while outbound and coupled processes positively influence organizational innovation. However, being a family firm (FF) moderates these relationships: for higher levels of inbound and outbound processes, being a FF influences product innovation more positively than being a non-FF; for higher levels of coupled process, FFs perform better than non-FFs in terms of process innovation; for higher levels of inbound (outbound) OI, organizational innovation is higher for non-FF (FF) firms. Our results contribute to the ability-willingness paradox, showing how, once adopted, family firms are more able than their non-family counterparts to benefit from OI processes, but also shed light on possible criticalities that family firms could face with respect to organizational innovation.

Keywords: open innovation; family firms; product innovation; process innovation; organizational innovation

1. Introduction

Drawing from open innovation (OI) and family business literatures, this paper explores to what extent open innovation processes influence a firm's innovativeness - *product*, *process* and *organizational* innovation (Calabrò et al. 2016) - and whether being a family firm (FF) impacts these relationships.

Albeit extant research distinguishes among three OI processes, namely *inbound*, *outbound* and *coupled* processes (Enkel et al. 2009, West and Bogers, 2014), it has been characterized on a focus on one of the three processes (Brunswick and Vanhaverbeke 2015; Kobarg et al. 2019; West and Bogers 2014), on the impact of search *breadth* and *depth* (Laursen and Salter, 2006) on innovation – or, more in general, firm - performance (Greco et al. 2016; Kobarg et al. 2019; Moretti et al. 2018). Thus, to what extent different OI processes influence firms' innovativeness remains underexplored. This is quite surprising since understanding whether pursuing an inbound, outbound or coupled OI process for enhancing innovativeness could turn to be useful, especially in fast changing environments.

Moreover, despite the increased attention paid by family business researchers on innovation in family firms (Feranita et al. 2017), to what extent being a family firm may moderate these relationships has been unplumbed. Preliminary studies comparing family and non-family firms have shown that they differ in terms of *product innovation process* (De Massis et al. 2015), that family firms have lower search *breadth* (Alberti et al. 2014) or recur to closer networks of relationships (Basco and Calabrò 2016). Indeed, family firms possess unique characteristics and they are characterized by the so-called *ability-willingness paradox* (Chrisman et al. 2015), according to which they are less willing to innovate, but more able to do so than their non-family counterparts. The reasons reside in the preservation of socio-emotional goals that lead to avoid risk, prefer to retain managerial control in the family hands rather than opening-up top management position to non-family members, grow in an

incremental way. In such a context, it is not difficult to understand that FFs could exploit OI processes to different extents.

This research is based on a unique database comprising 119 Italian firms that apply high technology to cultural goods. This is a particular context characterized by highly heterogeneous firms that are competing in a niche market (that of cultural goods) and whose technologies often derive from the cross-fertilization of multiple knowledge domains (see Casprini et al. 2014 for an overview).

The paper is organized into 5 sections. Section 2 presents the theoretical background and the hypotheses development. Section 3 describes the methodology adopted, with a description of the unique sample investigated. Then, the Findings are summarized in Section 4. The paper concludes with a discussion on the results, and the implications for both academics and managers (Section 5).

2. Theoretical background and hypotheses development

2.1 Open Innovation and Innovativeness

Open innovation is usually defined as “*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively*” (Chesbrough et al. 2006:1). Research on the topic is flourished in the last decade as clearly demonstrated by the several literature reviews on the topic (Huizingh 2011; Lopes and de Carvalho 2018) and agrees on distinguishing three main types of OI, namely inbound, outbound and coupled OI processes (Enkel et al. 2009; West and Bogers 2014). Inbound OI consists in sourcing external knowledge (Brunswick and Vanhaverbeke 2015) and acquiring inputs through in-licensing (Bianchi et al. 2011; Dahlander and Gann 2010). Outbound OI processes refer to the out-licensing and the revealing of internal resources (Dahlander and Gann 2010). Specifically, “*outbound OI*

suggests that rather than relying entirely on internal paths to market, companies can look for external organizations with business models that are better suited to commercialize a given technology” (Chesbrough and Crowther 2006: 229). Coupled OI processes (Enkel et al. 2009; West and Bogers 2014) or, as some other scholars have defined it, innovation collaboration (Kobarg et al. 2019), relate to “*co-creation with (mainly) complementary partners through alliances, cooperation, and joint ventures during which give and take are crucial for success”* (Enkel et al. 2009: 313).

Due to the clear conceptual distinction among these three processes, it is not surprising to find several conceptual and empirical papers that have sounded out specific aspects of this trichotomy, such as their *pecuniary* and/or *not-pecuniary* modes (Dahlander and Gann 2010), the search *breadth* and *depth* (Greco et al. 2016; Larsen and Salter 2006), the *governance forms* (Felin and Zenger 2014). On the contrary, it is very rare to find out contributions examining which of the three OI processes lead to higher innovativeness. In particular, a recent literature review (Lopes and de Carvalho 2018) notices that innovation performance has been often measured in terms of new product, R&D, intellectual property and turnover. Others have looked at the impact of OI on innovation and/or financial performance (Caputo et al. 2016; Hinteregger et al. 2018; Moretti and Biancardi 2018). For example, Greco et al. (2016) have investigated the effect of OI on firm performance showing that search breadth and search depth differ with respect to radical or incremental innovation. However, a crucial distinction with respect to innovation is that among product, process and organizational innovation (Calabrò et al. 2016). These are three different forms of innovativeness and, in their broadest terms, are linked to the novelty of new products/services introduced to the market and/or new products/services to the firm (Crossan and Apaydin 2010), new production processes (Crossan and Apaydin 2010), and new management practices.

Being incremental or radical in intensity, these types of innovation result to be very different each other's. Among them, product innovation has attracted the greatest attention from open innovation scholars. But dealing with OI processes should lead us to consider the different innovation outcomes.

Contributions on the impact of OI of a firm's innovativeness are quite fragmented, showing positive, negative or non-linear effects (see Caputo et al. 2016 for an overview). Consequently, our paper purposively presents three broad hypotheses that move from two main considerations. On the one side, the adoption of OI processes lead to an increase of the firm's knowledge base that may results in higher innovation performance, especially in terms of innovation intensity. As seminal contributions shown (e.g. Pittaway et al. 2004), collaboration and networking benefit innovation thanks to risk sharing, access to new markets, knowledge and technologies, reduction of time-to-market, among the others. On the other side, the management of OI processes is not always an easy task since it requires to be able to explore and exploit external and internal knowledge, to deal with multiple and different partners for which coordination costs may be higher than the benefits resulting from collaboration, and it could not be positively related to innovation performance. Often collaborations and networks fail due to inter-firm conflicts, lack of infrastructure (Pittaway et al. 2004), strategic misalignment. Thereof, we propose the following three hypotheses:

Hp 1. Inbound OI process influences product innovation (Hp1a), process innovation (Hp1b) and organizational innovation (Hp1c)

Hp 2. Coupled OI process influences product innovation (Hp12a), process innovation (Hp2b) and organizational innovation (Hp2c)

Hp 3. Outbound OI process influences product innovation (Hp3a), process innovation (Hp3b) and organizational innovation (Hp3c)

2.2 The moderating role of Family influence

Family firms are undoubtedly interesting with respect to their innovation processes. Due to their particularistic goals – one for all the preservation of their socio-emotional wealth - and unique resources, family scholars have increasingly explored to what extent they are different from their non-family counterparts in innovation inputs, activities and outputs. According to recent contributions, family firms “*may have lower innovation inputs than non-family firms but achieve greater outputs*” (Dielman 2018: 3), albeit, as Basco and Calabrò (2016) argue, “*a priori it is not possible to define which form of organization (family or non-family) is more innovative in products, services or processes. However family and non-family firms might differ in their paths to achieving innovation*” (p. 285).

Previous studies on open innovation in family firms are scarce and very recent. Focusing on the heterogeneity of family firms, extant research has described the unique capabilities family firms develop in executing open innovation (Casprini et al. 2017), how family firms are able to implement innovative production while maintaining traditions (Della Corte et al. 2018), which are the main drivers and challenges that FF face with respect to open innovation (Lambrechts et al. 2017), and whether family owned and managed or family owned and non-family managed influences OI (Lazzarotti and Pellegrini 2015). Other scholars have emphasized the differences between family and non-family firms. Preliminary analyses show that in their product innovation processes, family firms tend to be more closed than non-family firms (De Massis et al. 2015), prefer *closest networks of relationships* than non-family firms (Basco and Calabrò 2016) and have a *lower search breadth* (i.e. less partners) (Alberti et al. 2014). As Chrisman et al. (2015) notes, “*in their attempt to preserve control over innovation, family firms do not have the same inclination to engage in open innovation [...] even though they are thought to have superior ability in identifying opportunities and acquiring knowledge from outside their boundaries*” (p. 312).

Indeed, as advanced by *the ability and willingness paradox* (Chrisman et al., 2015), family firms are less willing to innovate due to their risk aversion, the fear of losing control, the attachment to traditions, but also more able to do so due to their relationships and long-term orientation. However, previous studies have under-investigated the fact that, once adopted, family firms are more able to take advantage from open innovation processes in general, due to their governance structure and the unique social capital that can facilitate knowledge transfer (Habbershon and Williams, 1999). Taking a resource-based view perspective, in fact, family firms can leverage on their unique resources and hence being able to combine them to reach innovativeness (Duran et al., 2016; Pucci et al. 2017).

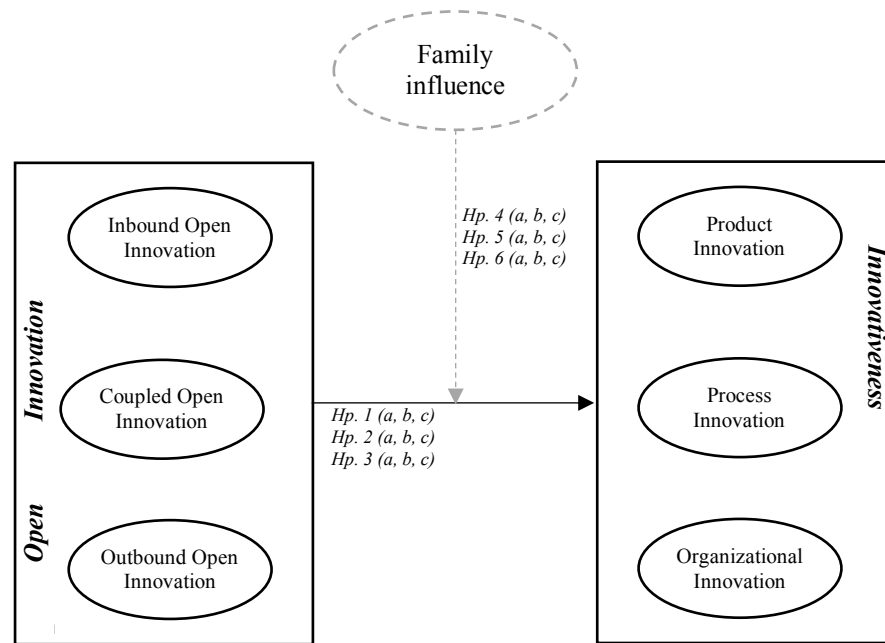
Consequently, this study advances three other hypotheses:

Hp 4. *Family firms engaged in inbound OI processes will exhibit higher product innovation (Hp4a), process innovation (Hp4b), organizational innovation (Hp4c) than non-family firms.*

Hp 5. *Family firms engaged in coupled OI processes will exhibit higher product innovation (Hp5a), process innovation (Hp5b), organizational innovation (Hp5c) than non-family firms.*

Hp 6. *Family firms engaged in outbound OI processes will exhibit higher product innovation (Hp6a), process innovation (Hp6b), organizational innovation (Hp6c) than non-family firms.*

Figure 1. The conceptual model



3. Methodology

3.1 Sample and data collection

The sample consists of Italian firms using high technology for cultural goods. Due to the lack of a SIC code for such a type of firms, we selected them through following Casprini et al. (2014)'s contribution, checking each firm websites in order to understand whether the firm deals with cultural goods or not. Firms that apply high technology to cultural goods are an interesting sample due to the specificity of the context characterized by high interdisciplinarity and cross-fertilization. The survey was electronically sent to about 1,000 emails addresses. Basic information was collected from the AIDA Bureau van Dick database. Questionnaires were collected from January 2017 and October 2017. We received 119 questionnaires, which account for 11,9% response rate. The firms are operating in both high tech and lower tech industries (Chesbrough and Crowther 2006).

3.2 Measures

3.2.1 Dependent variable. Innovativeness was the dependent variable of this research. Following Calabrò et al. (2016) we distinguished among product innovation, process innovation and organizational innovation.

3.2.2 Independent variables. Independent variables were all measured through multiple-items scales. In particular, *Inbound OI processes* comprised in-licensing, purchase of external R&D services and crowdsourcing (Bianchi et al., 2011; Enkel et al., 2009). These items referred to both external technology and knowledge acquisition (Lopes and de Carvalho, 2018). *Outbound OI processes* looked at both internal technology and knowledge exploitation (Lopes and de Carvalho, 2018). Hence, we considered spin-offs, incubators, out-licensing (Bianchi et al., 2011; Enkel et al., 2009; West and Bogers, 2014). Finally, *Coupled OI processes* looked at university research grants, joint venturing, co-creation with clients, R&D consortia (Enkel et al., 2009; West and Bogers, 2014). The reliability of these scales was high, with a Cronbach's α of 0.912 for Inbound OI, 0.922 for Coupled OI and 0.960 for Outbound OI. Table I presents an overview.

3.2.3 Moderating variables. In order to distinguish between family and non-family firms, we categorized as “family firm” that firm fulfilling all of the following criteria: considers itself as a family firm, owns more than 50% (+1) of shares and has family members involved in the top management team. This measure is similar to that used in other studies (Pucci et al., 2017).

3.2.4 Control variables. Several control variables were considered during the analysis. Indeed, we controlled for *Size* and *Age* (Caputo et al., 2016; Lopes and de Carvalho, 2018). In addition, due to the fact that our sample presents firms from multiple sectors and different levels of R&D, we also looked at *Foreign Sales* (Kobarg et al. 2019), *R&D expenditures* - often used as a proxy for absorptive capacity and representing an important factor explaining to what extent firms are able to assimilate external knowledge (West and Bogers, 2014), and *Public*

Procurement (for firms operating with cultural goods, this may represent an important source of financing).

Measures description is presented in *Table 1*. VIF scores are in the Appendix.

Table 1: Measures Description and Properties

Measures	Item Description*	Rotated Factor Load.	Sources
Product Innovation $\alpha = 0.880$ AVE = 0.653	<i>To what extent your firm can be characterized by ...</i>		Calabrò <i>et al.</i> , (2016)
	x1: ... being the first company in the industry to introduce new products or services?	0.805	
	x2: ... developing completely new products / services to sell in new markets?	0.669	
	x3: ... introducing new products / services to be sold in already existing markets?	0.829	
Process Innovation $\alpha = 0.895$ AVE = 0.688	<i>To what extent your firm can be characterized by ...</i>		Calabrò <i>et al.</i> , (2016)
	x4: ... commercializing new products/services?	0.690	
	x5: ... investing heavily in innovative / risky technological research and development processes?	0.621	
	x6: ... being the first firm in the industry to develop and introduce totally new technologies?	0.657	
Organizational Innovation $\alpha = 0.878$ AVE = 0.643	<i>To what extent your firm can be characterized by ...</i>		Calabrò <i>et al.</i> , (2016)
	x7: ... being pioneers in the creation of new technological processes?	0.664	
	x8: ... copying (in the sense of owning) technological processes of other companies?	0.740	
	x9: ... being the first firm in the industry to develop innovative business management systems?	0.733	
Inbound Innovation $\alpha = 0.912$ AVE = 0.776	Open <i>Indicate how much your firm recurs to:</i>		Adapted from: Bianchi <i>et al.</i> (2011), Enkel <i>et al.</i> (2009)
	x17: in-licensing	0.881	
	x18: purchase of external R&D services	0.783	
Outbound Innovation $\alpha = 0.960$ AVE = 0.891	Open <i>Indicate how much your firm recurs to:</i>		Adapted from: Bianchi <i>et al.</i> (2011), Enkel <i>et al.</i> (2009), West and Bogers (2014)
	x19: crowdsourcing	0.876	
	x20: spin-offs	0.884	
Coupled Innovation $\alpha = 0.922$ AVE = 0.753	Open <i>Indicate how much your firm recurs to:</i>		Adapted from: Enkel <i>et al.</i> (2009), West and Bogers (2014)
	x21: incubators	0.951	
	x22: out-licensing	0.931	
	x23: university research grants	0.820	
	x24: joint venturing	0.836	
	x25: co-creation with clients	0.766	
	x26: R&D consortia	0.904	

Note: *Each item varies on 1-5 Likert scale where “1” indicates “not important/agree” and “5” means “the highest importance/agreement”.

3.3 Analysis

Based on this unique database on 119 Italian firms, the hypotheses are tested through a hierarchical moderated multiple regression analysis.

4. Results

Table 2 presents the descriptive statistics and correlation analysis. *Table 3* depicts the results from the hierarchical moderated multiple regression analysis. Model B shows that *inbound* and *coupled* OI processes positively influence *product* and *process* innovation, while *outbound* and *coupled* OI processes positively influence *organizational innovation*. Hence Hp1a, Hp1b, Hp2a, Hp2b, Hp2c, and Hp3c are supported. Consequently, our results suggest that coupled OI processes are particularly important in order to achieve all product, process and organizational innovation.

Second, we investigated the impact of being family influenced on these relationships. Regarding *Inbound OI processes*, family influenced firms perform better than non-family firms in terms of product innovation (Hp4a supported), but worse in terms of organizational innovation (Hp4c supported, but with negative sign) (Model C). Focusing on *Coupled OI processes*, family firms perform better in terms of process innovation (Model E), thus supporting only Hp5b. Finally, for what concerns *Outbound OI processes*, being a family firm positively influences product innovation and organizational innovation (Model D), thus supporting Hp6a and Hp6c. *Table 4* presents a summary of the results.

In addition, it is also interesting to note that size has a positive and significant effect on organizational innovation.

Table 2: Measures, correlations and descriptive statistics

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
[1] Product Innovation	0.808											
[2] Process Innovation	0.699	0.829										
[3] Organizational Innovation	0.501	0.503	0.802									
[4] Inbound Open Innovation	0.458	0.395	0.254	0.881								
[5] Outbound Open Innovation	0.383	0.390	0.425	0.324	0.944							
[6] Coupled Open Innovation	0.528	0.622	0.443	0.358	0.542	0.868						
[7] Family Influence	-0.037	-0.102	0.058	0.117	0.096	-0.010	-					
[8] Size (LN)	0.072	0.074	0.198	0.011	-0.001	-0.019	0.037	-				
[9] Age (LN)	-0.047	-0.061	0.026	-0.074	0.035	0.028	0.386	0.237	-			
[10] Foreign Sales (%)	0.110	0.143	-0.037	0.052	0.100	0.138	-0.066	-0.067	0.005	-		
[11] R&D Exp. (%)	0.323	0.374	0.202	0.171	0.172	0.416	-0.133	-0.019	-0.091	0.382	-	
[12] Public Procurement (%)	-0.052	-0.165	-0.107	-0.074	-0.012	-0.147	-0.146	-0.072	-0.032	-0.218	-0.108	-
Mean	2.868	2.700	2.498	1.966	1.815	2.275	0.370	1.895	2.897	7.748	10.933	47.487
Std. Dev.	1.020	0.989	0.941	1.115	1.182	1.120	0.485	1.033	0.649	18.533	13.108	31.117
Min	1	1	1	1	1	1	0	0	1.099	0	0	0
Max	5	5	5	5	5	4.750	1	4.654	4.477	90	54	100

Note: N = 119; Values in bold on the diagonal are the square root of the AVE. Correlation coefficients greater than 0.198 in absolute value are statistically significant at 95%.

Table 3: Model Comparison Results of Hierarchical Moderated Multiple Regression Analysis

	Model A	(SE)	Model B	(SE)	Model C	(SE)	Model D	(SE)	Model E	(SE)
Product Innovation										
Size (LN)	0.089	0.090	0.088	0.078	0.084	0.076	0.094	0.076	0.088	0.078
Age (LN)	-0.034	0.145	-0.043	0.136	-0.049	0.134	-0.070	0.134	-0.047	0.136
Foreign Sales	-0.001	0.005	0.000	0.005	-0.000	0.005	0.001	0.005	0.000	0.004
R&D Exp.	0.055**	0.020	0.011	0.019	0.017	0.019	0.016	0.019	0.011	0.019
R&D Exp. square	-0.001	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000
Public Procurement	-0.000	0.003	0.001	0.003	0.001	0.003	0.002	0.003	0.001	0.003
Inbound Open Innovation			0.267***	0.077	0.117	0.105	0.269***	0.076	0.269***	0.078
Outbound Open Innovation			0.083	0.080	0.079	0.078	-0.070	0.106	0.077	0.081
Coupled Open Innovation			0.300**	0.093	0.309**	0.091	0.285**	0.091	0.271*	0.110
Family influence			-0.105	0.180	-0.675*	0.326	-0.596*	0.292	-0.253	0.360
Inbound Open Inn. X Family inf.					0.289*	0.138				
Outbound Open Inn. X Family inf.							0.286*	0.135		
Coupled Open Inn. X Family inf.									0.067	0.142
Cons.	2.411***	0.487	1.348**	0.448	1.615***	0.459	1.606***	0.457	1.421**	0.475
Process Innovation										
Size (LN)	0.083	0.085	0.085	0.070	0.085	0.071	0.088	0.070	0.086	0.069
Age (LN)	-0.055	0.136	-0.046	0.123	-0.046	0.124	-0.059	0.123	-0.061	0.121
Foreign Sales	-0.001	0.005	0.000	0.004	-0.000	0.004	0.000	0.004	-0.000	0.004
R&D Exp.	0.054**	0.019	0.011	0.017	0.011	0.017	0.013	0.017	0.010	0.017
R&D Exp. square	-0.001	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000
Public Procurement	-0.004	0.003	-0.003	0.002	-0.003	0.002	-0.002	0.002	-0.002	0.002
Inbound Open Innovation			0.169*	0.070	0.156	0.097	0.170*	0.070	0.178*	0.070
Outbound Open Innovation			0.060	0.072	0.060	0.073	-0.019	0.098	0.041	0.072
Coupled Open Innovation			0.403***	0.084	0.403***	0.085	0.395***	0.084	0.299**	0.099
Family influence			-0.235	0.163	-0.287	0.302	-0.489^	0.268	-0.774*	0.322
Inbound Open Inn. X Family inf.					0.026	0.128				
Outbound Open Inn. X Family inf.							0.147	0.124		
Coupled Open Inn. X Family inf.									0.245*	0.127
Cons.	2.472***	0.458	1.421***	0.407	1.445***	0.425	1.554***	0.421	1.687***	0.425
Organizational Innovation										
Size (LN)	0.171*	0.084	0.180*	0.076	0.184*	0.075	0.187*	0.074	0.180*	0.076
Age (LN)	0.011	0.135	-0.062	0.133	-0.055	0.131	-0.095	0.129	-0.054	0.133

Foreign Sales	-0.007	0.005	-0.007	0.005	-0.006	0.004	-0.006	0.004	-0.007	0.005
R&D Exp.	0.027	0.019	-0.002	0.018	-0.007	0.018	0.004	0.018	-0.001	0.018
R&D Exp. square	-0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Public Procurement	-0.003	0.003	-0.002	0.03	-0.002	0.003	-0.000	0.003	-0.002	0.003
Inbound Open Innovation			0.053	0.076	0.206*	0.103	0.056	0.074	0.049	0.076
Outbound Open Innovation			0.209**	0.078	0.212**	0.077	0.015	0.103	0.218**	0.079
Coupled Open Innovation			0.221*	0.091	0.212*	0.089	0.203*	0.088	0.274*	0.108
Family influence			0.056	0.176	0.637*	0.318	-0.566*	0.282	0.330	0.352
Inbound Open Inn. X Family inf.					-0.295*	0.135				
Outbound Open Inn. X Family inf.							0.362**	0.130		
Coupled Open Inn. X Family inf.									-0.125	0.139
Cons.	2.100***	0.456	1.440**	0.439	1.168*	0.449	1.767***	0.442	1.304**	0.464
<i>R</i> ² (Product Innovation)	0.131		0.391		0.414		0.415		0.392	
<i>R</i> ² (Process Innovation)	0.180		0.465		0.465		0.472		0.483	
<i>R</i> ² (Organizational Innovation)	0.105		0.311		0.340		0.358		0.316	
<i>Incr. F-test</i>	-		7.06***		4.94**		3.24*		2.12^	

Note: N = 119; ^ p < 0.1 * p < 0.05, ** p < 0.01, *** p < 0.001

Table 4. Summary of the findings

	Product Innovation	Process innovation	Organizational Innovation
Inbound OI processes	Hp1a: supported (Positively influence)	Hp1b: supported (Positively influence)	Hp1c: not supported
<i>Family influence</i>	<i>Hp4a: supported (family firms perform better than non-family firms)</i>	<i>Hp4b: not supported</i>	<i>Hp4c: supported but with reverse sign (family firms perform worse than non-family firms)</i>
Coupled OI processes	Hp2a: supported (Positively influence)	Hp2b: supported (Positively influence)	Hp2c: supported (Positively influence)
<i>Family influence</i>	<i>Hp5a: not supported</i>	<i>Hp5b: supported (family firms perform better than non-family firms)</i>	<i>Hp5c: not supported</i>
Outbound OI processes	Hp3a: not supported	Hp3b: not supported	Hp3c: supported (Positively influence)
<i>Family influence</i>	<i>Hp6a: supported (family firms perform better than non-family firms)</i>	<i>Hp6b: not supported</i>	<i>Hp6c: supported (family firms perform better than non-family firms)</i>

Figure 2 shows the relationship between inbound OI processes and product (left) or organizational (right) innovation. As we can note, for higher levels of *Inbound OI processes*, being a FF influences product innovation more positively than being a non-FF, while it negatively influences organizational innovation. However, a positive impact of being family influences is also found with respect to *Outbound OI processes* and both product and organizational innovation (Figure 3), and *Coupled OI processes* and process innovation (Figure 4). These findings seem to empirically support the higher ability of family firms in exploiting open innovation, but leave with two main caveats. Firstly, it is important to distinguish among the open innovation processes since family firms appear to be good in managing *Outbound OI processes*, while less able to deal with *Coupled OI processes* and sometimes perform worse in *Inbound OI processes* than their non-family counterparts. Secondly, we cannot consider innovativeness as a unique concept, but we need to distinguish along its different dimensions to nuance family firms' higher ability in exploiting OI processes.

Figure 2. The moderating effect on family influence on Inbound OI and product (left) or organizational (right) innovation relationship.

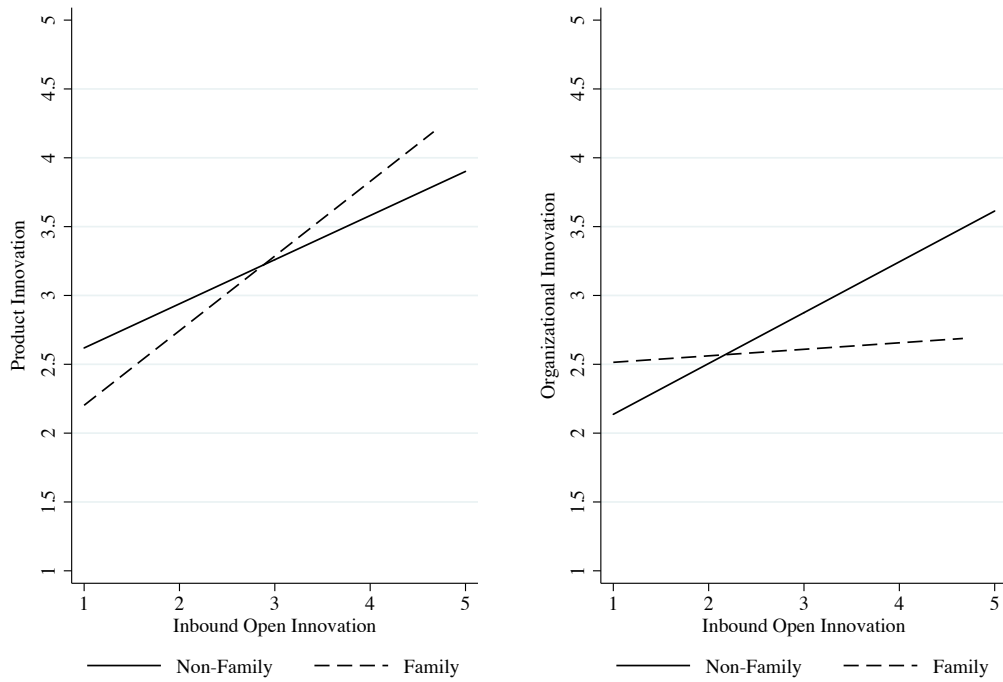


Figure 3 The moderating effect on family influence on outbound OI and product (left) and organizational (right) innovation relationship.

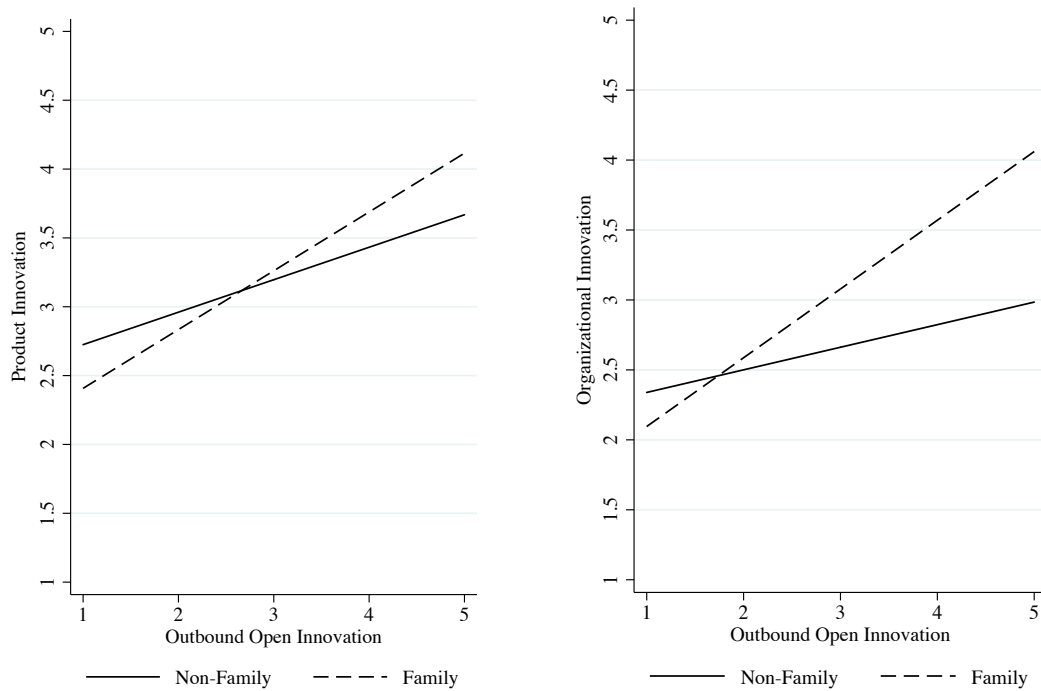
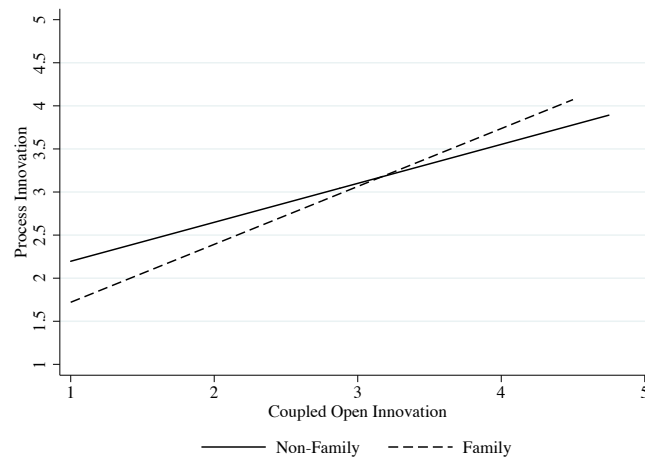


Figure 4. The moderating effect on family influence on coupled OI and process innovation relationship.



5. Discussion and conclusion

In a scenario even more characterized by collaboration among multiple actors, understanding which are those *open innovation* (OI) processes that influence a firm's innovativeness is crucial. It is well known that open innovation processes are heterogenous, but their impact on the firms' innovativeness in terms of product, process and organizational innovation is unclear. Using an unique dataset of 119 Italian firms applying high tech for cultural goods, our findings show that family firms perform better than non-family firms in product innovation for higher levels of inbound and outbound OI processes, in process innovation for higher levels of coupled OI process, and in organizational innovation for higher levels of outbound OI. However, family firms seem to underperform on organizational innovation when they recur to higher levels of inbound OI. This is quite surprising since family firms might be in a better position than non-family firms in experimenting organizational innovation thanks to the overlap between their ownership and management. A fairly recent literature review (Verbano et al., 2015) summarizes the barriers firms have to overcome when dealing with open innovation, such as the quality of partners, managerial complexities and cultural resistances. For example, the not invented here syndrome is one of the main barriers to overcome with respect to inbound OI processes (Antons

and Piller, 2015). Our findings suggest that family firms are more able to overcome inbound OI barriers to pursue product innovation, but they are worse than non-family firms with respect to organizational innovation. This might be due to the fact that family firms face more resistance in exploiting inbound OI processes to innovate their organization in terms of introducing new management practices or changing their organizational structure.

Our results contribute to the ability-willingness paradox (Chrisman et al. 2015) according to which family firms are less willing to adopt innovation, but when they do so they are particularly able to manage it. Furthermore, our study presents a twofold contribution: showing the impact of the three OI processes (inbound, outbound and coupled) on the three dimensions of a firm's innovativeness (product, process and organizational innovation) and adding to previous research on the differences between FFs and non-FFs with respect to OI.

Limitations are linked to the sample size and the fact that our firms belong to a single country. In addition, contrary to previous studies that have investigated firms belonging to a cluster (Basco and Calabrò, 2016), our paper has focused on firms belonging to multiple industries but applying high technologies to cultural goods. This implies that our findings may be linked to the specificities linked to this context.

Future research could further investigate the heterogeneity of family firms and the heterogeneity of open innovation processes. For example, according to Lazzarotti and Pellegrini (2015), non-family managed FFs have a broader search breadth. But, do family managed and non-family managed firm tend to behave differently in implementing OI processes? Furthermore, as other papers did, we can conceptualize different types within each OI process. For example, Brunswicker and Vanhaverbeke (2015) have identified five types of searchers on the basis of firms interaction with their innovation partners, namely minimal, supply chain, technology oriented, application-oriented and full-scope sourcing. Future research could investigate to what extent they influence the firm's innovativeness. Moreover, due to the

heterogeneity of open innovation processes, we suggest to investigate whether family firms could be better able to exploit those OI processes that could preserve their socioemotional wealth and maintain control.

From a practitioner standpoint, our analysis alerts FFs and non-FFs suggesting them to recur to inbound, outbound and coupled processes to different extents based on whether they want to pursue product, process or organizational innovation. On the one side, it seems that there is a threshold after which family firms are better able to exploit inbound OI for product innovation (Figure 2), outbound OI for product and organizational innovation (Figure 3), coupled OI for process innovation (Figure 4). This might be explained by the fact that family firms could suffer of a learning gap when the level of OI processes is low, while they are good in benefiting more than their non-family counterparts when the level of openness is higher. On the other side, they face an ability gap in exploiting inbound OI for organizational innovation. This gap could derive from lower managerial capabilities that obstacle family firms to benefit from higher level of inbound OI processes, especially when the firm size increase. Future research should better investigate why family firms perform worse than non-family firms in terms of organizational innovation for higher level of inbound OI processes and to what extent their size may influence this relation. Thereof, our results open an arena future research for both OI and family business scholars as well as practitioners.

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Appendix

Appendix I: VIF scores and tolerances among study variables

Variables	VIF scores	Tolerance
Inbound Open Innovation	1.23	0.815
Outbound Open Innovation	1.50	0.665
Coupled Open Innovation	1.81	0.553
Family Influence	1.29	0.775
Size (LN)	1.09	0.921
Age (LN)	1.30	0.769
Foreign Sales (%)	1.25	0.802
R&D Exp. (%)	1.43	0.697
Public Procurement (%)	1.12	0.890

Mean VIF: 1.34. Condition number: 19.321