Gender Board Composition and Performance in Italian Start-Ups

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Abstract: Literature on start-ups has mainly involved functional and education diversity of top teams; gender has been neglected, most likely because of the low presence of women in technological firms. Also, extant research has overlooked the role of female representation in start-ups' boards, despite boards represent a key piece in the puzzle that enables the functioning and survival of new firms. Building on this gap, we aim to investigate the following research question: *are gender-related variables in the board of innovative start-ups correlated with better performance*? We employ a novel dataset of 3,257 Italian innovative start-ups founded between 2012 and 2018, and we run eight OLS regressions to estimate performance as a function of measures of female representation. Our results provide evidence of a positive relation of gender-related variables with performance. Specifically, we find that gender diversity is related to an efficient use of assets (ROA), while the shares and the number of females are related to an efficient use of capital (ROE). We also detect a non-linear exponential relation between the number of females in the board and ROE: as more women serve in the board, returns on equity grow more than proportionally. Our paper contributes to the literature on board composition and start-up performance by providing new evidence on the role of female representation.

Keywords: start-ups, firm performance, gender diversity, board, Italy

1. Introduction

Board composition is recognized as a critical element in how decisions are undertaken, which ultimately impacts on firm performance (Adams *et al.*, 2010). A large body of literature has specifically dealt with female representation in boards and firm performance, finding mixed empirical evidence (Post and Byron, 2015). The decision-making process at the top level is especially crucial for start-ups (Colombo and Grilli, 2010; Shrader and Siegel, 2007), as early-stage entrepreneurial decisions may have an important effect on survival and performance. Despite the crucial role of boards in start-ups' functioning and survival, its composition has been studied mostly in terms of outside status, while diversity has been neglected (Li *et al.*, 2020); in particular, gender board composition of start-ups is rarely investigated, most likely because women are underrepresented in young start-ups (Dai *et al.*, 2019). This paper contributes to this stream of literature by addressing the relation between female representation in boards and financial performance of innovative start-ups.

Many scholars have focused on whether different dimensions of human capital (e.g. education, industry experience) in the boards of start-ups are correlated to firm performances (Li *et al.*, 2020). Since start-ups have leaner organizations, the linkage between boards and performance is stronger (Shrader and Siegel, 2007). One important dimension that affects how boards take decisions is diversity, since diverse boards bring heterogeneous resources, which may improve decision-making. As female representation in apical managerial positions increases, literature has considered gender as a relevant demographic dimension of board diversity, but results regarding its effect on performance are mixed (Post and Byron, 2015). The relevance of the issue is clear: since there are still few women in boards (Bennouri *et al.*, 2018), providing evidence that their increased representation boosts firm performance would have practical implications for managers and policy makers, even if we do not consider the purely ethical importance of more females on boards (Campbell and Mínguez-Vera, 2008).

Our empirical analysis is based on a dataset of 3,257 Italian *innovative start-ups* founded between 2012 and 2018, supported by a specific law (D.L. 179/2012). We estimate their performance in 2019 as a function of female representation in boards. We also investigate the curvilinear relation between females in boards and performance to assess whether there is a "critical mass" effect of female representation (Joecks *et al.*, 2013). Our preliminary results provide evidence of a positive relation of gender-related variables with performance.

We offer new insights on the relation between female representation in boards and performance in two novel ways. First, the bulk of studies mainly look at listed large firms (Carter *et al.*, 2010; Fernández-Temprano and

Tejerina-Gaite, 2020). Second, existing research is mostly based in US, and, for Italy, it is focused on the mandatory gender quota for listed companies (Bennouri *et al.*, 2018). Hence, as far as we know, this study is the first one to investigate the role of female representation in boards of start-ups on their financial performance.

The paper is organized as follows. Section 1 reviews the literature on female representation in the board and firm performance. Section 2 develops the hypotheses. Data and methodology are presented in Section 3, while results are deployed in Section 4. Finally, Section 5 draws the conclusion.

2. Theoretical framework

The issue of whether female representation in boards affects performance has been investigated under the broader umbrella of the relation between board diversity and firm performance. Women are found equally competent and qualified along many dimensions (Terjesen *et al.*, 2009), but they may have gender-specific characteristics that increase board diversity, such as in terms of previous working experience or approaches to problems (Bart and McQueen, 2013; Dai *et al.*, 2019).

Different theories have been used to study the relationship between female representation in boards and firm performance. These theories explain one or more mechanisms thanks to which board diversity may ultimately affect firm performance; however, it seems that no single theory predicts whether such relation should be positive or negative (Carter *et al.*, 2010).

According to agency theory (Carter *et al.*, 2003), diversity may increase the capacity of the board to act independently in its crucial function of monitoring managers. Alternative theories point out that a well-functioning board is primarily based on the presence of a range of expertise (e.g. finance, knowledge of the technology), as for example highlighted by the theories based on human capital (Terjesen *et al.*, 2016; Volonté and Gantenbein, 2016). Also resource dependence theory has been used in this context, according to which diverse boards are better able to create linkages with external stakeholders to bring resources internally (Ali *et al.*, 2014); this aspect could be particularly important for new ventures that lack internal resources.

Upper echelons theory (UET) posits that executives differ in their cognitive frames, which in turn influence firm outcomes (Hambrick, 2007). Executives have different experiences and personalities that strongly influence their evaluation. Hence, the characteristics of boards will influence firm performance. The cognitive frames of the top executives are very difficult to measure, but demographic dimensions (e.g. race or gender) have been demonstrated to be valid proxies (Post and Byron, 2015).

Finally, in the context of innovation, the resource-based theory of the firm (RBT) (Barney, 1991) offers additional insights on why the demographic characteristics of the board may influence firm performance. Human capital and organizational resources are especially difficult to imitate and explain superior performance of firms (Galbreath and Galvin, 2008). Therefore, diverse boards constitute a unique bundle of resources to be leveraged against competitors.

3. Female representation: Empirical evidence

The empirical evidence of whether female representation in boards affects firm performance is mixed: positive (Ahmadi *et al.*, 2018; Campbell and Mínguez-Vera, 2008; Carter *et al.*, 2010; Darko *et al.*, 2016; Green and Homroy, 2018; Isidro and Sobral, 2015; Joecks *et al.*, 2013; Reguera-Alvarado *et al.*, 2017; Rubino *et al.*, 2021; Vieira, 2017), negative (Ahern and Dittmar, 2012; Joecks *et al.*, 2013; Luanglath *et al.*, 2019), and non-significant (Adams and Ferreira, 2009; Campbell and Mínguez-Vera, 2008; Fernández-Temprano and Tejerina-Gaite, 2020).

The evidence is mostly based on US companies, and on European countries that introduced mandatory law for female quotas in listed companies such as Norway, Spain, and Italy (Ahern and Dittmar, 2012; Campbell and Mínguez-Vera, 2008; Isidro and Sobral, 2015). The majority of studies use listed companies. An exception is Gloor et al. (2020), who study the impact of board member composition on new venture success; here, the female share in the board has not been found relevant.

Empirical studies differ also in the measures of female representation and performance, which partially explain the heterogeneity of results. The majority of these works use the simple share of females in the board, some works use a dummy of whether there is at least a woman, or dummies for 2 or at least 3 women, as well dummies

for 30% threshold (Campbell and Mínguez-Vera, 2008; Green and Homroy, 2018; Isidro and Sobral, 2015; Joecks *et al.*, 2013). Some studies differentiate between female presence in committees, or between independent and executive females (Carter *et al.*, 2010; Rubino *et al.*, 2021). Other studies use diversity index, such as Blau's and Shannon's (Campbell and Mínguez-Vera, 2008; Joecks *et al.*, 2013; Luanglath *et al.*, 2019; Reguera-Alvarado *et al.*, 2017). In terms of firm performance, studies have considered mostly market performance (e.g. Tobin's Q), and accounting measures (e.g. return on assets, returns on equity, return on sales, market-to-book equity ratio).

Finally, there is a group of studies that detect a relation that vary depending on the number of females. This is related to the critical mass theory. For example, Schwartz-Ziv (2017) finds that the presence of three or more women on the board has a greater impact on performance than boards with two or fewer women. Joecks et al. (2013) find a U-shaped relation, for which 30 per cent of women in the board is the threshold after which firm performance becomes positive.

Technological new ventures rely heavily on increasing the variety of knowledge base, and successfully integrate such knowledge (Dai *et al.*, 2019). The creative process benefits from knowledge and experience of the individuals within organizations, included the top level (Grant, 1991). Women on boards increase the diversity since they have different approaches to problems, they take less risky decisions, and they have different socialization experiences, career paths, and social networks with respect to men. In addition, although predominantly male fields such as IT sectors may constitute a barrier to women, start-ups are leaner and less structured than established firms, hence power struggles and biases are less intense. In start-ups women may have more opportunities to effectively impact on board decisions and firm performance since in such environments their different perspectives and insights represent valuable and rare resources (Dai *et al.*, 2019). Therefore, we expect that:

H1 Female representation in terms of diversity will be positively correlated to firm performance.

H2 Female representation in terms of presence will be positively correlated to firm performance.

In addition, we build on critical mass theory stating that group has a voice when there is minimum number of similar members (Joecks *et al.*, 2013). Hence, we also test for non-linear relation between the number of females and performance:

H3 Female representation in terms of presence will have a curvilinear relation with firm performance.

4. Data and methodology

4.1 Sample

An *innovative start-up* is a particular form of joint stock company regulated by the Italian law (Decreto legge 179/2012) aimed at supporting the whole lifecycle of new young firms with high-tech content, and high-growth potentials[1].

From the database AIDA by Bureau van Dijk, in July 2021 we collected Italian active innovative start-ups that were funded between 2012 and 2018[2]. The initial dataset downloaded contains some variables of interest such as: company name, incorporation year, industry classification by NACE Rev.2, return on asset in 2019, return on equity in 2019, number of employees in 2019, number of current directors and managers who specified their gender and age. These pieces of information were used to create the relevant variables at the firm level. In particular, the individual-level information on board members were aggregated in meaningful variable at the firm-level. The final sample is composed from 3208 start-ups.

It is noticeable that after 2013 the number of firms funded each year rapidly increases. Although the year reporting highest frequency is 2017 (i.e., 1017 start-ups), the highest growth rates are concentrated in the period between 2014-2016. This may be explained by the fact that, although the law was introduced in 2012, it took some time for entrepreneurs to react to the related incentives and leverage the law by creating new start-ups. Regarding the sectors, manufacturing ones represent only 19.3% of the total sample. Within these latter, high-tech and medium-high tech account for 60%. Non-manufacturing sectors represent the majority of firms

[1] https://www.mise.gov.it/index.php/en/202-news-english/2033818-italy-a-smart-choice-for-innovative-startups

[2] We include firms with non-zero employees in 2019, 2018 or 2017 to exclude too small or problematic firms.

(80.7%). In particular, 42.67% of the total sample is classified as "Computer programming, consultancy and related activities". Regarding the size of the *start-ups* within the sample, firms show a low number of employees, and this is coherent with their young age. Specifically, the range of employees go from 0 to 176, with an average of 1.24. Usually, the only employee is the director who also is the founder or has the full ownership of the firm. In terms of revenues, the average amount is 114 thousand euro, with a maximum of about 3.5 million of euro in 2018.

4.2 Dependent variables

Following extant research (Campbell and Mínguez-Vera, 2008), we use two measures of financial performance, which are return on asset in 2019 (*ROA2019*) and return on equity in 2019 (*ROE2019*). ROA is calculated as net income divided by total assets and reflects how efficiently firms use resources to generate profits. ROA is a more balanced view of profitability compared to traditional metrics. ROE is measured as the net profit divided by shareholders' equity. It measures the capacity of the firm to transform the invested capital into income. ROE does not consider the risk that financial leverage creates.

4.3 Key independent variables

Blau_index is an index of heterogeneity calculated as:

$$B = 1 - \sum p_i^2$$

where *p* represents the proportion of each *i* category (which is male and female) on total board members. The Blau's index is obtained by subtracting to 1 the sum of the squared proportions. The index ranges from zero, representing homogeneity in the board, to 0.5, representing maximum gender diversity (Campbell and Mínguez-Vera, 2008). *Homophilia* is a dummy variable equals to 1 when all members are of the same gender, 0 otherwise. *ShareFemale* is the proportion of females in the board. *DM_F* represents the number of women in the board. We also use the squared term (*DM_F*^{2}) to test for non-linearity.

4.4 Control variables

The models include a set of controlling variables. *Board_size* represents the total number of directors and managers, which is generally found negatively related to performance (Joecks *et al.*, 2013). *DMAge* represents the mean age of directors and managers, as older members may have more experience (Fernando *et al.*, 2020). We control for firm age (*Log_age*, taken in the logarithm), as the capacity to generate profit increases in older firm (Delgado-Márquez *et al.*, 2017). *Log_size* is the number of employees in 2018, taken in logarithm. From literature, we can expect a positive significant effect of size on performance measures (Fernando et al., 2020). Following the classification of Eurostat based on NACE Rev. 2 at 2-digit level of manufacturing firms, we control for high-tech (*high*), medium-high tech (*medhigh*), medium-low tech (*medlow*), and low-tech (*low*) sectors. Non-manufacturing firms (*No_manu*) account for primary, extraction and service sectors. This category is used as benchmark. Table 1 reports all the variables used with main statistics.

Table 1: Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
ROA2019	3,106	-6.91	45.58	-741.05	152.72
ROE2019	2,534	4.52	45.95	-149.84	149.54
board_size	3,208	1.56	1.35	1	30
log_age	3,208	0.58	0.49	0	1.79
DMAge	3,204	46.67	10.83	21	88
log_size	2,815	0.44	0.69	0	517.61
blau_index	3,208	0.03	0.12	0	0.5
homophilia	3,208	0.91	0.28	0	1
sharefemale	3,208	0.17	0.35	0	1
DM_F	3,208	0.25	0.55	0	15
DM_F^2	3,208	0.37	406.46	0	225
high	3,208	0.03	0.17	0	1
medhigh	3,208	0.08	0.27	0	1
medlow	3,208	0.02	0.16	0	1

Variable	Obs.	Mean	Std. Dev.	Min	Max
low	3,208	0.05	0.21	0	1
no_manu	3,208	0.80	0.39	0	1

4.5 Methodology

Our main model of interest is firm performance as a function of different measures of female representation on the board, and a set of controls. Since we have two measures of performance and four measures of female representation on boards, we run eight OLS regressions with the same controlling variables, and robust standard errors. In particular, we estimate the following general model:

$$\textbf{\textit{Perf}} = \beta_0 + \beta_1 board\_size + \beta_2 log\_age + \beta_3 DMAge + \beta_4 log\_size + \beta_j fem\_repr + \beta_i sector + \varepsilon$$

where ***Perf*** represents the two dependent variables used as proxies of the performance of firms (i.e. ROA and ROE) in 2019. *Board_size*, *log_age*, *DMAge* and *log_size* are the control variables as described above. ***Fem_repr*** designate the four measures of female representation on boards (i.e. *blau_index*, *homophilia*, *sharefamale*, *DM_F* and DM_F^2), and ***sector*** the four dummies for manufacturing sectors (i.e. *high*, *medhigh*, *medlow*, and *low*); ε is the error term.

5. Results and discussion

We check the correlations of our variables which do not raise concerns about multicollinearity[3].

Table 3 shows the regression results. For ROA, we have significant results for the heterogeneity indicators. Blau's index is positively significant at 1% level. *Homophilia*, consistent with the Blau's index, is negative and significant. This suggest that firms with gender board diversity are more efficient in using assets compared to firms that incorporate homogeneous boards. Neither the shares of females nor the number of women (and its quadratic term) are statistically significant.

For ROE, gender diversity is not statistically significant, while we have significant results for the female presence. *ShareFemale* has a significant and positive relation with the capacity of the firms to create value for shareholders. Both number of women in the board (*DM_F*) and its squared version (DM_F^2) result to be positive and significant, which suggests a non-linear exponential relation between the number of females and ROE. As the number of women in the board increases, the relation with performance becomes stronger. Ceteris paribus, any additional woman in the board increases the ROE by 4.07 percentual points up to a certain level, after which the contribution to ROE of each added female would be further 0.38 percentual points in ROE. In sum we found that H1 is supported for ROA, H2 and H3 are supported for ROE.

In terms of control variables, *board_size* resulted to be negative and statistically significant in both ROA and ROE. The age of the firm (*log_age*) is significant and negative only in ROE models, in line with previous findings (Isidro and Sobral, 2015). In both ROA and ROE, *log_size* is positive and statistically significant, suggesting that larger firms achieve higher performance. As for technological sector, medium-high tech firms have higher performance in terms of ROA.

Table 2: Regression models

	ROA	ROA	ROA	ROA	ROE	ROE	ROE	ROE
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
board_size	-1.809***	-1.862***	-1.235***	-1.775***	-3.408***	-3.400***	-2.988***	-4.422***
	(0.557)	(0.598)	(0.478)	(0.555)	(1.080)	(1.146)	(0.921)	(0.855)
Log_age	2.095	2.099	2.184	2.207	-5.849***	-5.838***	-5.801***	-5.717***
	(1.539)	(1.540)	(1.539)	(1.539)	(2.104)	(2.105)	(2.101)	(2.099)
Log_size	2.140**	2.133**	2.112**	2.036**	7.070***	7.068***	6.995***	6.786***
	(0.884)	(0.884)	(0.885)	(0.887)	(1.375)	(1.374)	(1.381)	(1.366)
DMAge	-0.0388	-0.0389	-0.0390	-0.0335	-0.0621	-0.0623	-0.0513	-0.0438
	(0.0679)	(0.0679)	(0.0689)	(0.0687)	(0.0925)	(0.0925)	(0.0926)	(0.0926)
blau_index	14.50***				9.718			

[3] The correlation table is not displayed. It is available upon request.

	ROA	ROA	ROA	ROA	ROE	ROE	ROE	ROE
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	(4.933)				(8.341)			
homophilia		-6.038**				-3.650		
		(2.443)				(3.942)		
shareFemale			1.029				6.252**	
			(2.274)				(2.771)	
DM_F				1.832				4.079*
				(1.677)				(2.186)
DM_F^2				0.145				0.388**
				(0.114)				(0.160)
high	2.802	2.787	2.833	2.857	-0.933	-0.944	-0.557	-0.790
	(2.587)	(2.588)	(2.599)	(2.609)	(4.682)	(4.682)	(4.728)	(4.726)
medhigh	3.369**	3.354**	3.216*	3.291*	4.934	4.912	4.652	4.924
	(1.702)	(1.703)	(1.693)	(1.692)	(3.258)	(3.258)	(3.250)	(3.246)
medlow	3.996	3.927	3.720	3.815	0.0893	0.0197	0.0566	0.125
	(2.901)	(2.899)	(2.898)	(2.898)	(5.012)	(5.012)	(5.032)	(5.001)
low	-3.922	-3.915	-3.936	-4.005	-9.755*	-9.728*	-10.19*	-10.09*
	(4.400)	(4.399)	(4.357)	(4.378)	(5.254)	(5.249)	(5.215)	(5.226)
Constant	-4.089	2.062	-4.613	-4.345	13.91***	17.61***	12.09**	13.91***
	(3.720)	(4.406)	(3.909)	(3.807)	(4.731)	(6.495)	(4.813)	(4.715)
Observations	2,740	2,740	2,740	2,740	2,240	2,240	2,240	2,240
R-squared	0.007	0.007	0.005	0.006	0.021	0.021	0.023	0.026
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1								

As a further step, in Figure 1 we show the marginal effect of the number of females in the board on ROE, with 95% confidence interval. We can observe the non-linear relation found in the estimations. As the number of females increases, ceteris paribus, ROE grows more than proportionally.

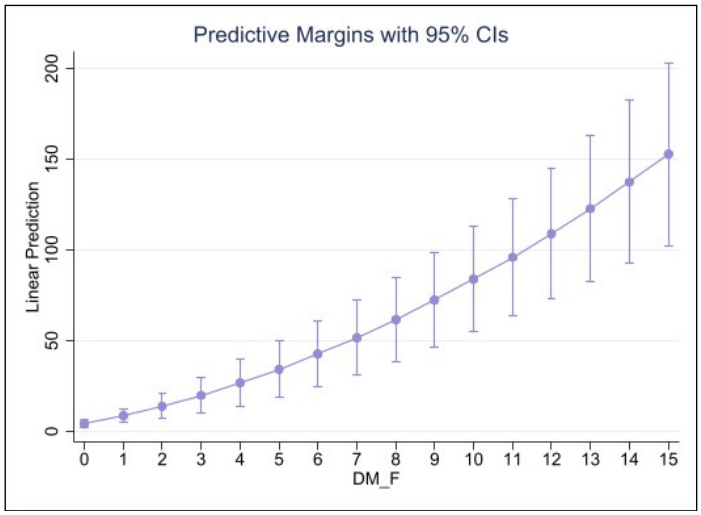

Figure 1: Marginal effects between the number of females in boards and ROE

6. Conclusion

Our findings show that female representation in boards is positively correlated to firm performance. In particular, firms with heterogeneous boards seem to be more efficient in using assets (i.e. ROA), while firms incorporating boards with more women seem to be more efficient at using the shareholders' capital (i.e. ROE). Our results on ROA and gender diversity reveal a mechanism for which women increase innovation in start-ups via greater knowledge differentiation and integration at the level of board (Dai *et al.*, 2019). As women have different career paths than men, and different cognitive frames to identify opportunity (DeTienne and Chandler, 2007), gender-diversified boards favour innovation and facilitate the transformation of assets into profit. In addition, start-ups have to navigate greater uncertainty (Goldfarb *et al.*, 2018) compared to established firms and when dealing with uncertainty, creative solutions may be extremely valuable (Gilson *et al.*, 2005). Finally,

the presence of women has been found to improve peer monitoring between genders in boards (Schwartz-Ziv, 2017), so that gender-balanced teams make better decisions regarding the management of assets.

Our results on ROE and female presence suggest that women in corporate boards may be more efficient at using shareholders' capital as they pursue fewer risks in investments; these less risky decisions do not reduce firm competitiveness, but instead make firms more profitable (Chen *et al.*, 2016; Nadeem *et al.*, 2019). Such insight may be particularly valuable for start-ups, which have limited resources and need to carefully select their investment choices and adopt a more balanced risk attitude. We also find an exponential relation between women and ROE, so that as female representation into the boards increases, firm efficiency in managing capital increases more than proportionally. This may be explained by the fact that each additional woman amplifies the voice of the other women (i.e. critical mass theory) (Schwartz-Ziv, 2017) and, as women show specific characteristics (e.g. in terms of risk and investment attitudes) firms with increased female representation may be able to draft more carefully planned and informed decision-making processes, thus positively affecting firm performance.

Our findings contribute to extant research that points to the advantages of increasing female representation within corporate boards (Post and Byron, 2015). The empirical literature on the relation between female representation (i.e. gender diversity or female presence) and performance is mixed. Such literature has mainly focused on US and on listed companies, while our study has provided novel results by looking at an Italian sample of SMEs with high-growth potentials as identified by a specific regulation. We believe that this is a novel contribution that responds to a call for more research on gender board composition in entrepreneurial firms (Li *et al.*, 2020). Our study is not without limitations, as we have provided preliminary evidence of a relation that requires further investigation. First, our study suffers from endogeneity; as the supply of female managers and directors in start-ups is lower, women may self-select into better firms. Longer time-period and panel structure may partially correct for that. Second, endogeneity may come from omitted variable bias. Controlling for other sources of board diversity (e.g. education, social network) or other dimensions of the board (e.g. role of venture capital, family ownership) may help to understand to what extend gender matters.

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