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Board Diversity and Efficiency Evaluation Evidence from European Listed Manufacturing Companies

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Abstract: Board diversity can influence performance. Our research analyses the relationship between corporate efficiency and board diversity in Eurospean listed manufacturing companies for the year 2015 (n = 451). In particular we investigate the effects on profitability efficiency of gender inclusion, i.e., the inclusion of women as well as Foreigners on boards as diversity management variables. In order to assess the profitability efficiency we rely on a non-oriented, Slack-Based Model (SBM) for Data Envelopment Analysis (DEA) and a Logistic regression analysis (Logit) to identify the effect of diversity management variables. The results demonstrate that the increased presence of women on boards is associated with a higher probability for greater relative efficiency in those countries without mandatory gender regulation. The increased presence of Foreigners on boards, however is associated with a lower probability of above-average efficiency. To the best of our knowledge, this is the first combined application of a non-oriented, SMB DEA Model and logistic regression.

Key words: Corporate performance, board diversity, gender diversity, national diversity, profitability efficiency, DEA

INTRODUCTION

The purpose of this study is to focus on the board diversity-performance relationship (Loden and Rosener, 1991; Berghe and Levrau, 2004; Kiel and Nicholson, 2003; Rose, 2006, 2007a, b; Dahya and McConnell, 2007), highlighting how the presence of women (Shrader *et al*., 1997; Carter *et al*., 2003; Adams and Ferreira, 2009) and Foreigners on boards (Ujunwa, 2012; Peng *et al*., 2003) influences corporate performance in terms of profitability efficiency (Luo, 2003).

Board diversity represents a significant corporate governance mechanism in order to achieve efficient management and monitoring within companies (Boone *et al*., 2007). As the EU Commission indicates, the diversity issue is of great importance in increasing the monitoring quality of both management and board.

Walt and Ingley (2003) describe diversity in corporate governance as the composition of the board and combination of the different qualities, characteristics and expertise of individual members related to board decision-making and other processes.

This topic is of significance regarding normative perspectives in fact some countries have recently enacted guidelines and/or mandatory regulation in order to increase women's presence on the boards of listed companies, i.e., gender quotas. But it is also of significance concerning managerial perspectives i.e., gender and national diversity which affect the decision-making process, improve economic results, increase media visibility and demonstrate commitment to social and ethical issues. Theories like the agency theory, the stakeholders theory and the resource dependency theory provide a comprehensive understanding of the connection between corporate governance, board diversity and corporate performance. These include the relevance of a virtuos relationship with stakeholders, as proposed by both stakeholder theory (Donaldson and Davis, 1991) and resource dependence theory (Pfeffer and Salancik, 2003). The agency theory (Jensen and Meckling, 1976) advocates that diversity is a main requirement for a fair and transparent decision-making process when measuring independence (Luoma and Goodstein, 1999).

However, despite the extensive scope of studies no consolidated theoretical framework has been made, nor has there been conclusive empirical evidence regarding how (or if) certain board features, concerning gender and national diversity, influence corporate performance. The main purpose of this study is to provide new evidence about the relationship between board diversity and corporate performance.

Our sample covers the analysis of 451 European listed manufacturing companies for the year 2015. Unlike previous empirical studies we have used the profitability efficiency as a measure of corporate performance. In order to evaluate the profitability efficiency measurement, we

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have designed a set of scores, using the Data Envelopment Analysis DEA (Farrell, 1957; Charnes *et al*., 1978; Fare and Lovell, 1978) in a non-oriented Slack Based Measure SBM Model (Tone, 2001).

A data Logistic regression analysis (Logit) (Bajari *et al*., 2009; Kant, 2001) was used to check whether there was a relationship between profitability efficiency scores and diversity management variables. We tested the effect on corporate performance of the mandatory presence of women on boards, introduced by some European governments. We took the critical mass theory into account as an additional confounding factor.

To the best of our knowledge, this is the first combined application of a non-oriented SMB DEA Model and logistic regression in order to evaluate the impact of diversity management on performance. This study is structured as follows: firstly, the theoretical background then an explanation of data and methodology, results and finally discussion and conclusions.

Litreature review

Theoretical background: The connection between virtuous governance, board diversity and performance is covered extensively in literature (Adams and Ferreira, 2009; Campbell and Mînguez-Vera, 2008; Gallego-Alvarez *et al*., 2010; Jackling and Johl, 2009; Post and Byron, 2015; Siciliano, 1996).

Carter *et al*. (2003), however, found that dominant theories on corporate governance do not provide a solid or complete explanation of any significant impact of diversity on performance. In fact, Kiel and Nicholson (2003) suggest that due to the multi-disciplinary nature of the topic no single theory can provide a complete frame work for the relationship between diversity and performance. Based on these findings we have designed a multi-theoretical framework that incorporates insights from agency, stakeholder and resource-dependence theories.

Table 1 gives a brief description of the main theories of board diversity effects and performance expectations. It is worthy of mention that board governance diversity led researchers to consider the connection between the level of diversity and a firm's economic results (Carter *et al*., 2010). This relationship between increased diversity and firm performance has gained wide acceptance in recent literature and in fact many previous empirical studies have attempted to test whether greater diversity on boards has a positive impact on a company's performance or value.

This literature maintains that heterogeneous groups conceive higher quality decisions (Robinson and Dechant, 1997), create additional innovative solutions through cognitive conflict (Chen *et al*., 2005) and influence a firm's strategy (Miller and Triana, 2009).

In fact, prior research (Perryman *et al*., 2016; Bear *et al*., 2010; Campbell and Minguez-Vera, 2008; Smith *et al*., 2006; Bonn *et al*., 2004; Carter *et al*., 2003; Erhardt *et al*., 2003; Adler, 2001) suggests that increasing numbers of women on boards are keen to improve their companie's economic results. On the other hand there is another research stream that finds a negative relationship between the number of female corporate board members and a firm's performance (Akpan and Amran, 2014; Darmadi, 2013; Carter *et al*., 2010; Adams and Ferreira, 2009; Andres *et al*., 2005; Pelled *et al*., 1999;

Table 1: The multi-theoretical framework

Theory	Brief description	Board diversity approach	Performance expectations	Researchers
Agency theory	The interests of the owner and the manager are divergent. The manager has information that the owner doesn't have which can create information asymmetry	A more heterogeneous board improves control because a wider range of views increases board independence. Diversity on the board can be a mechanism to reduce costs associated with agency problems	Profit is the main performance objective for the owner. Agency problems hinder the owner from achieving company objectives. Monitoring and incentive alignment are necessary to mitigate agency problems for the owner to achieve desired performance	Alchian and Demetz, (1972), Jensen and MecKling (1976) Fama and Jensen, (1983), Jensen (1983), Mallin (2004), Clarke, (2007), Tosi (2008) Hillman and Dalziel (2003)
Stakeholder theory	The manager is simultaneously seen as an agent of multiple stakeholders, instead of shareholders alone	Diversity can be understood as an important indicator of a firm's Qcorporate social responsibility and a sign of a stakeholder-oriented firm Greater diversity on the board allows more open government processes that ensure the incorporation of stakeholder interests	Managers need to reach a trade-off between the various interests of different stakeholders. Maximising profit is not the only corporate objective	Hill and Jones (1992), Näsi (1995), Carroll, (1996), Clarkson (1998), Macey (1998), Jensen, (2000), Freeman *et al*. (2010), Ibrahim and Angelidis (1994), Oakley, (2000), Hillman *et al*. (2002)
Resource dependency theory	The focus is on the relationship between ownership, management and company's environmental dimension, shifting attention to the outside innovation	Diversity improves the quality of board decisions, contributing to enhancing the firm's decision-making problem solving empower creativity capabilities and business performance benefits from different perspectives and experiences	Board members establishing external links increase critical resourcing which leads to better performance	Gabrielsson and Huse (2004), Siciliano (1996) Voordeckers *et al*. (2007)

Shrader *et al*., 1997) while some research even found no relationship between the two variables (Rose, 2006, 2007 a, b; Randoy *et al*., 2006; Zahra and Stanton, 1988). Recently, the European debate on gender equality and promoting measures has focused on the role of introducing gender quotas that may break the glass ceiling i.e., obstacles that women face to get top positions in business. According to the latest data published by the European Commission in January 2015, the average number of women on the largest listed company boards in Europe is about 20.2%. Compared to 2010 when the same figure was 11.9% the increase is significant. Differences between countries are nevertheless very marked: in France, Finland and Sweden it exceeds 25% whereas in countries such as Ireland or Portugal women do not reach 10% of total directors. The only country, albeit outside the EU which comes to 40% is Norway, a pioneer in introducing gender quotas, followed, recently by Italy. The increase recently observed in Europe, however is due to enhancements focused in countries where a mandatory gender regulation has been introduced.

However, in addition to the effect of mandatory gender regulation, a confound investigation factor arises from critical mass theory (Konrad *et al*., 2008). This theory suggests that when a certain threshold is reached (a critical mass) the impact of a subgroup (such as "women on the board") becomes more noticeable. Kramer *et al*. (2006) argue that "a board with three or more women is more likely to experience the positive effects and contributions to good governance than a board with fewer women". According to Kanter (1977), having only one member of a demographic group can lead to tokenism. Tokens are considered to represent an entire demographic group (women) and are seen by the dominant group (men) as a stereotype. Based on critical mass, research into the relationship between female directors and performance might require a distinction between boards with one woman and boards that have reached a certain threshold. This standardisation counteracts the "tokenism phenomena" which implies that companies only include a few female board positions in order to satisfy external expectations (Torchia *et al*., 2011).

An additional diversity variable is the international board composition (national diversity). This variable is rarely investigated and Anonymous (2014) show that the percentage of Foreigners on boards in Europe increased from 11-23% between 2007 and 2009. Empirical research demonstrates that national diversity is expected to gain importance due to globalising tendencies. An increasing number of empirical research studies (Ujunwa *et al*., 2012; Ujunwa, 2012; Rose, 2007 a, b; Randoy *et al*., 2006; Oxelheim and Randoy, 2003; Peng *et al*., 2003) measure the positive influence of foreigners on boards and companie's performance. Oxelheim and Randoy (2003) only observe foreigners who are originally from the US, Canada or England UK due to the planned adaption of the Anglo-American corporate governance system.

Darmadi (2011) examines the association between board membership diversity and financial performance on firms listed on the Indonesia Stock Exchange (IDX) finding that nationality diversity has no influence on firm's performance. Kim and Lim (2010) even report that Foreigners on boards can have a negative impact.

Using the theoretical framework mentioned above, we have tested whether board gender and national diversity are linked to positive profitability efficiency results. These are the research questions:

RQ1: Are increased numbers of women on company boards in countries adopting a mandatory legislative framework positively related to higher profitability efficiency results?

RQ2: Are increased numbers of foreigners on company boards positively related to higher profitability efficiency results?

MATERIALS AND METHODS

Data: The sample design is of 451 manufacturing listed companies from 6 European countries (France, Germany, Italy, Spain, Portugal and United Kingdom), selected for the year 2015. Information about financial data and board diversity variables was obtained from the AIDA database, publicly available corporate governance reports and financial statements. Companies presenting outlier variables were removed. Table 2 shows countries companies number and data about board composition.

In order to detect the mandatory gender regulation effect, we analysed countries adopting a mandatory legislative regulation (France, Italy and Spain, n = 173) separately from those that do not adopt a similar legislative framework (Portugal, United Kingdom and Germany, n = 278).

Description of variables

On corporate performance: In order to measure corporate performance we relied on the profitability efficiency. Efficiency is the ratio of output to input for a given production unit under given conditions while profitability

Table 2: Data description

Country	Companies (n)	Directors (n)	Women directors (n)	Foreign directors (n)	Total women directors (%)	Total Foreign directors (%)
France	77	659	172	57	26.10	8.65
Germany	92	913	154	94	16.87	10.30
Italy	69	545	116	25	21.28	4.59
Portugal	5	55	11	14	20.00	25.45
Spain	27	401	38	6	9.48	1.50
United Kingdom	181	2200	355	366	16.14	16.64

Table 3: Descriptive statistics of the sample dataset

Women (%)	Min	Max	Mean	Median	SD	Gender quota target
France	0.00	0.80	0.26	0.25	0.15	Yes
Italy	0.00	0.67	0.19	0.20	0.16	Yes
Spain	0.00	0.23	0.10	0.11	0.07	Yes
Germany	0.00	0.50	0.13	0.13	0.13	No
Portugal	0.00	0.43	0.25	0.22	0.14	No
United Kingdom	0.00	0.55	0.14	0.14	0.13	No
Foreigners (%)						
France	0.00	0.62	0.07	0.00	0.14	-
Germany	0.00	0.50	0.09	0.04	0.12	-
Italy	0.00	0.30	0.03	0.00	0.07	-
Portugal	0.00	1.00	0.29	0.10	0.42	-
Spain	0.00	0.13	0.02	0.00	0.03	-
United Kingdom	0.00	0.83	0.14	0.08	0.18	-

efficiency is the company's ability to generate revenue and profit based on its current labour, assets and capital stock. Outputs should be the key business drivers critical to business success and inputs should be the resources that lead to the key business drivers. This study uses fixed/total assets and costs of employees/operating revenue as input resources while outputs are ROE and ROA ratios.

On board diversity: As proxies for board diversity, we relied on two variables: percentage of women and foreigners (Table 3).

Research-methodology: We followed a two-stage research design. In the first stage, we relied on a specific Data Envelopment Analysis (DEA) Model, selecting two inputs and two outputs in order to compute the relative profitability efficiency scores for each company (Decision-Making Unit-DMU) in the sample. In the second stage, the profitability efficiency score results served as the dependent variables and the board diversity features served as proxies for the independent variables. In order to evaluate the effect of mandatory gender regulation we divided the dataset into three parts: all countries (A), countries with mandatory gender regulation (B) and countries without it (C).

First stage; Estimated efficiency scores: We computed the 451 companie's relative profitability efficiency by relying on DEA. DEA is a non-parametric approach to measuring the relative efficiencies of a group of peer units-Decision Making Units (DMUs). We relied on the non-oriented Slack-Based Model (SMB) (Tone, 2001). The SBM identifies inefficiencies with a better discrimination power than the radial Models CRS (Charnes *et al*., 1978; Fare and Lovell, 1978) and VRS (Banker *et al*., 1984). It simultaneously accounted for the excess of inputs and lack of outputs, providing profitability efficiency scores ranging from 0 (minimum level) to 1 (highest level).

Therefore, we preferred the non-oriented SBM under the VRS frontier assumption because it accurately discarded the effects of input and output approaches. Avkiran (2011) described the SBM as the best non-radial model where only semi-positive inputs are allowed but where outputs can also be negative (Cooper *et al*., 2007). In our case, the input ratio variables are Fixed/Total assets and costs of employees/operating revenue and the outputs are ROE and ROA ratios which are sometimes negative due to bad performance.

Where:

$$\min \tau - \frac{1}{m}\sum_{i=1}^{m} 1\frac{S^-}{XA}x_{i0}$$

$$\sum_{i=1}^{m}\frac{S^-}{XA}x_{i0}$$

$$tx_0 = X\mathbf{\Lambda} + S^-$$

$$ty_0 = Y\mathbf{\Lambda} - S^+$$

$$\mathbf{\Lambda} \geq 0,\ S^- \geq 0,\ S^+ \geq 0,\ t>0 \qquad (1)$$

Our dataset consists of n DMU with X = (x_{ij}) input $\in R^{mXn}$ and Y = (y_{ij}) $\in R^{sXn}$matrices being λ a non-negative vector in R^n being t is a scalar variable >0. The VRS model is placed by imposing a constraint on λ such as $\sum_{j=1}^{n} \lambda_j = 1$. The vectors $S^- \in R^m$ and $S^+ \in R^s$represent the input excess and output shortfalls of the expression and are called slacks. Therefore, the efficiency condition is reached when S^{-*} = 0 and S^{+*} = 0 and there are no input excesses or no output shortfall in any optimal solution.

Second stage; Relationship with diversity board: The profitability efficiency scores are taken into account as the dependent variable while the percentage of foreigners and women on a board are the independent variables. Our dependent variable is continuous but it does not range values that are from minus infinity to plus infinity and consequently we shifted it into a dummy variable. Therefore, the dummy dependent variable is equal to 1 if the company achieves an efficiency score higher than the average and 0 if it does not. The technique analysis relies on the Logistic regression (Logit) that unlike linear models is more suitable when the dependent variable is categorical. The logistic regression model is formulated as follows:

$$\text{Profitability efficeiency score } (PF) = \beta_0 + \beta_1 \%_{Women} + \beta_2 \%_{Freigeners} + \mu \quad (2)$$

$$\text{Profitability} = \text{Log}\left(P/(1\text{-}P)\right) = \beta_0 + \beta_1 \%_{Women} + \beta_2 \%_{Freigeners} + \mu \quad (3)$$

RESULTS AND DISCUSSION

The profitability efficiency scores are computed through Eq. 1 for each company (DMU). Only six companies reached the highest level while 91% had an efficiency level ranging from 0.5 and 3% 0.75. The whole sector suffers from a lack of overall efficiency. The mean of profitability efficiency on SBM-VRS is 0.3014 (A). Countries adopting gender regulation quotas' average efficiency result is 0.3212 (B) while in those countries without gender regulation it is 0.3295 (C). A closer look into slacks results provides the weight of fixed assets on total assets and ROE revealing, respectively, an excess and shortfall against the optimal value.

Regression of the profitability efficiency scores on various independent variables (%women, %foreigners) for the year 2015, based on the logit regression analysis (2) show a Chi-squared of 1.563 (A) with 2° of freedom. Thus, revealing adequate goodness of the model adaptability. Within our two independent variables of concern, we identified a positive influence of women on corporate performance with a coefficient of 0.003. However, we found a negative relationship between the presence of foreigners (-0.008) and corporate performance. So, we reject RQ2. Our findings on national diversity are in line with the results of Eulerich *et al*., (2013) who identified a negative relationship between nationality diversity and corporate performance (Table 4).

Table 4: Results of logit regression analysis

Variables	A	B	C
Women	0.003*	-0.005**	0.002
	(0.007)	(0.010)	(0.010)
Foreigners	-0.008**	-0.027*	0.005
	(0.007)	(0.018)	(0.007)
Constant	-0.49	-0.238	-0.865
	(0.158)	(0.264)	(0.207)
Descriptive statistics			
Chi squared	1.563**	3.162*	0.532**
p-values	0.458	0.206	0.767
n.	451	173	278

*p-value<0.25; **p-value<0.90

The logit regression analysis results (B) display a Chi-squared of 3.162 (B) and a p-value of 0.206 thus, indicating an adequate adaptability model goodness. Countries adopting a mandatory gender legislative framework regulation, reveal a negative influence caused by women's presence with a coefficient of -0.005. However, we found a positive relationship between women (coefficient 0.002) and corporate performance in countries without a mandatory gender regulation (C). Based on critical mass, results related to countries with a mandatory regulation show a negative relationship between female directors and performance even when women's participation on boards reached a certain threshold (coefficient -0.353). So, we reject RQ1.

According to our research design, we observe that the mandatory gender regulation concerning women's presence probability effect Eq. 3 has a negative impact on corporate performance. In fact, the probability that a company reaches a high profitability efficiency score is greater when the presence of women on a board is voluntary.

With reference to (A), a 10% increase of Freigners on boards leads to a reduction of 1.87% in a companie's probability of achieving an above average efficiency level. This probability decreases further-reaching 3.69% when 20% of board members are Foreign.

Likewise, according to (B) in countries that practise positive discrimination for women a 10% increase of female board members leads to a reduction of 1.23% in a company's ability to achieve an above average efficiency level. This evidence enhances the decreasing trend of a further 2.44% when the presence of women on boards reaches the 28% level.

Table 5: The probability influence compared to the percentage of Foreigners and women on boards

Variables	Probability	Difference	
Foreigners on boards (A) (%)	0%	10%	20%
Probability	37.99	36.12	34.30
Difference	-1.87		-3.69
Women in countries with mandatory gender regulation (B) (%)	8	18	28
Probability	43.10	41.87	40.66
Difference	-1,23		-2.44
Women in countries without mandatory gender regulation (C) (%)	7	17	27
Probability	29.92	30.34	30.76
Difference	0.42		0.85

With (C) an increase of 10% points enhances the efficiency results of a 0.42% probability and 0.85% when female presence reaches the 27% level (Table 5).

CONCLUSION

This research offers new insight into the relationship between board diversity and corporate performance, measured through the profitability efficiency. Prior empirical research provides diverging results about the influence of board diversity on corporate performance. In our study, we analyse gender and national diversity on boards and their influence on firm performance. The empirical analysis was conducted on 451 European listed manufacturing firms for 2015.

We mostly found negative effects of board diversity characteristics on corporate performance, especially, regarding national diversity and for those countries with a mandatory gender regulation for the presence of women. Our findings may be explained by the fact that board diversity cannot only result in a competitive advantage but may also reduce communication, complicate decision-making processes, increase the risk of in-groups and out-groups and damage cohesiveness (Bassett-Jones, 2005). Consequently these negative effects may impair management quality and corporate performance.

Adams and Ferreira (2009) find a negative relationship between the diversity of the board and corporate performance due to over-monitoring carried out by women. Adams and Ferreira (2007) also observe that director's greater interference in the decision-making process could give rise to communication difficulties among administrators. In this case, gender diversity which is a new element within the board, may create disagreement among directors which could affect performance. Our research results are in line with Ahern and Dittmar's (2012) about mandatory women quotas resulting in lower company value. They also further confirm the fact that when companies are forced to designate women in some cases they rely on directors with no specific previous experience or special skills that are able to generate benefits. In fact, their operational limits create slow and unproductive decision making that then has a negative impact on business performance. Consequently, it is necessary to promote women's presence not by external coercive measures (such as laws) but within companies relying on social, labour justice and professional skills.

This study contributes to existing literature on board diversity and corporate financial performance by being the first study to use a combined application of DEA-SBM Model and a logit regression to evaluate the impact of diversity management on performance.

Furthermore, we analysed empirically the effects that mandatory regulation, introduced with the aim of increasing board gender diversity has on corporate performance. The results of this study show strong economic and public policy implications, especially for stakeholders, directors and law makers (mainly market regulators and governments), although, the research methods, designed for a specific sector, involve certain limitations.

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