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Does the presence of independent and female directors impact firm performance? A multi-country study of board diversity

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Abstract This study empirically analyzes whether gender diversity enhances boards of directors' independence and efficiency. Using data from 3,876 public firms in 47 countries and controlling for a wide set of corporate governance mechanisms, we find that firms with more female directors have higher firm performance by market (Tobin's Q) and accounting (return on assets) measures. The results also suggest that external independent directors do not contribute to firm performance unless the board is gender diversified. These results hold with respect to different estimation models and robustness tests. Overall, our findings provide evidence that the female directors enhance boards of directors' effectiveness. Finally, we find that firms that are concerned with board independence, and that firms in more complex environments are more likely to have gender-balanced boards.

Keywords Board of directors · Female directors · Firm performance · Independent directors · Return on assets · Tobin's Q

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1 Introduction

The board of directors is tasked with guiding and authorizing the firm's strategic decisions, including mergers, acquisitions, alliances, hiring/firing executives, and capital structures. These strategies, in turn, impact the firm's financial performance and overall capital expenditures. Recent corporate scandals (e.g., Lehman Brothers, Glitnir, and Dynegy) have led to even closer scrutiny of boards of directors' decisions and composition. Around the world, there are calls to diversify boards of directors. Two distinct types of board of directors characteristics are the directors' status as independent (e.g., external, non-executive) to the firm and gender (e.g., female). There is also significant pressure from certain stock exchanges and large institutional investors. For example, in the U.S., the NYSE and NASDAQ exchanges both stipulate that a substantial share of a firm's directors should be independent.

A separate but related issue concerns the appointment of women to boards. Sixteen national corporate governance codes encourage the appointment of female directors; fourteen countries mandate gender quotas for publicly traded firms (e.g., Norway and Spain) or state-owned enterprises (Terjesen et al. 2014; authors' calculations). The presence of independent and female directors varies by country, industry, and firm; however, the share on both populations is on the rise. For example, recent data from the UK indicates that independent and female directors are 72 and 15 % respectively and that women comprise 24.7 % of new appointments (Sealy and Vinnicombe 2013). Among the U.S. Fortune 1000, female directors comprised 5.6 % in 1990 and 12.3 % in 1999 (Farrell and Hersch 2005). By 2014, this share has risen to approximately 16.9 % (Catalyst 2014).

A large and growing stream of research investigates how the composition of a firm's board affects outcomes, however the results are mixed with respect to the impact of independent (Dalton et al. 1998) and female (Terjesen et al. 2009) directors. Despite significant interest from practitioners, policymakers, and academics, research has failed to explore board independence structure in a gender diversity framework. Scholars have called for further investigation of board gender diversity-firm outcome relationships (Adams et al., 2015; Bilimoria 2008; Terjesen et al. 2009) and multi-country studies (Grosvold and Brammer 2010; Terjesen and Singh 2008) to supplement the mainly one nation studies (e.g., Dezsö and Ross 2012; Kang et al. 2010; Ntim 2013). Furthermore, scholars have called for rigorous explanations of global corporate governance phenomena (Aguilera et al. 2008).

The present study aims to fill this gap by examining: Is the effect of independent directors on reducing agency costs enhanced by the board's gender balance? That is, if a firm's board of directors is composed of a large proportion of outside directors and all of these directors are male, can anyone (and stakeholders in particular) be certain that these directors are independent from the firm's management? If males and females in a firm have similar educational backgrounds and levels of workforce participation in a particular economy, why are so few females present on the firm's board? If the overall labor market is balanced, why should the market for directors be unbalanced? One might argue that this issue of gender representation on boards is

cultural and social in nature such that the society in a particular country views top management functions as more appropriate for men and that other jobs, such as housework, are more suitable for women (Gerson 1985; Schein et al. 1996). Despite the various reasons that a board of directors may be gender-imbalanced in favor of males, the message that this imbalance conveys to the public is that its selection was biased, at least in terms of gender. A board selected under biased conditions provides fewer guarantees of its independence and may have negative effects on firm performance. Our research explores this argument and analyzes the effect of board structure in terms of gender and outside membership on reducing agency costs and improving firm performance.

This study offers four contributions to the literature. First, we reconcile prior inconsistent and inconclusive findings by considering the conditions under which independent directors impact firm performance. Second, we consider a gender perspective, informing the debate on code recommendations and quota legislation for appointing independent directors and female directors. Third, our data from 3,876 public firms in 47 countries supplements the mostly single country studies. Finally, our research identifies a set of firm and country characteristics associated with greater numbers of female directors.

The remainder of the paper is organized as follows. Section 2 outlines the theoretical background and hypotheses. We then describe the data and methodology in section three. Sections 4 and 5 present and discuss the results. Section six concludes with a discussion of limitations and suggestions for future research.

2 Theoretical background and hypotheses

Our research examines two components of board composition: status as an independent outsider and female gender. While both types of members are expected to bring unique contributions to boards, their exact mechanisms are distinct. We begin by theorizing about how independent directors may influence firm outcomes, and then consider the influence of female directors on firm outcomes and board efficiency. There is not one universal theoretical framework; we draw on several theories to develop hypotheses.

2.1 Independent directors and firm performance

The board of directors' primary function is to advise on strategy formulation and decision-making (Holmstrom 2005; Adams and Ferreira 2007). An important component of these board tasks is monitoring executive management to ensure that managers pursue shareholders' best interests (Fama 1980; Fama and Jensen 1983). There is nearly universal agreement in academic research, policy, and practice that independent (also referred to as outside or non-executive) directors increase board transparency and monitoring. For example, around the world, corporate governance codes such as the Sarbanes–Oxley Act strongly suggest and often mandate that a board should be comprised of a significant share of independent directors. A large

literature analyzes the impact of independent directors on firm performance, with inconclusive findings.[1]

There are three key theoretical perspectives that suggest how independent directors may positively influence firm outcomes: agency theory, resource dependency theory, and upper echelons theory (Ruigrok et al. 2006). Agency theory focuses on the inherent conflicts between owner's interests and management interests. An agent theoretical perspective suggests that independent directors (from outside the corporation) have fewer potential conflicts of interest and can thereby provide greater integrity and offer impartial judgment (Fama 1980; Rosenstein and Wyatt 1997). Within this framework, Hermalin and Weisbach (1998) provide a theoretical model for analyzing board composition and effectiveness as a function of board independence. According to this framework, the CEO has incentives to influence the selection of a board that enables him/her to maximize his/her personal benefits. In contrast, directors have incentives to maintain their own independence, preventing them from being complacent about the CEO. In this context, the board's independence level emerges from a dynamic negotiation between the CEO and board of directors. Hermalin and Weisbach (1998) emphasize that exogenously requiring the addition of more outsiders to the board does not necessarily to a board that is more independent from the CEO. In fact, unless the new outside directors could influence the bargaining process, the board's independence would remain the same. Nevertheless, independent directors are expected to be more likely to represent shareholder interests and potentially take a stand against the CEO (Adams et al. 2010). These independent directors value their personal reputations, and will go to great lengths to preserve their reputations. According to Adams et al. (2010: 94), Fama's (1980) arguments suggest that "concern for his [director's] reputation will cause an agent to act more in his principal's interests than standard approaches to agency might suggest… strong reputation presumably aids in getting more board seats or retaining the ones already held, a weak reputation the opposite." Independent directors come to their boards with prior experience that may enable them to be more effective as monitors (Fama and Jensen 1983), particularly when they constitute the majority of the board (Adams et al. 2010; Fama and Jensen 1983).

A second key perspective is resource dependency theory which considers the role of external resources in affecting firm behaviors (Pfeffer and Salancik 2003). According to resource dependency theory, independent directors have access to valuable knowledge and relationship resources such as particular expertise, social

[1] For example, Brickley et al. (1997), Luan and Tang (2007), Florackis and Ozkan (2009), Kim and Lim (2010), Jackling and Johl (2009), and Pombo and Gutiérrez (2011) report a positive relationship between the percentage of independent directors and firm performance. In contrast, Hermalin and Weisbach (1991), Barnhart and Rosenstein (1988), Bhagat and Black (2002), Vafeas and Theodorou (1998), Klein (1998), and Arosa et al. (2010) find that the presence of independent directors does not increase firm value. Moreover, Agrawal and Knoeber (1996), Bebchuk and Cohen (2005), and Shan and McIver (2011) find that independent directors decrease value. Faleye et al. (2011: 177) report that intense monitoring by independent directors may negatively affect firm value, thus "suggesting that the costs of weak advising outweigh the board's monitoring." Nguyen and Nielsen (2010) find that the death of an independent director decreases shareholder value. Kang et al. (2007) report mixed results. Still other studies find no significant differences.

networks, and legitimacy which can be leveraged in their roles on the board (Hillman et al. 2002). Furthermore, independent directors' unique experiences garnered in other companies can be useful for high-level board decision-making (Finkelstein et al. 2009). Taken together with human capital theory concerning the role of the individual's cumulative education and experience (Becker 1994) and social capital theory concerning social networks as a key advantage (Coleman 1988), independent directors with unique education and work experience (external to the firm) may offer insightful knowledge to their boards and contribute to the success of the firm. Taken together, independent directors expand their firms' boundaries through linkages to important external resources (Hillman and Dalziel 2003).

Third, upper echelons theory describes how executives' behavior may be explained by personal experiences and values (Hambrick and Mason 1984). Executives' prior experiences are especially salient in board roles (Hambrick 2007) such that independent directors should be more likely to leverage their vast and diverse sets of knowledge and skills and thereby improve performance. Taken together, we suggest:

Hypothesis 1 The greater the firm's proportion of independent directors on its board, the better its performance.

2.2 Female directors and firm performance

Despite the substantial theoretical rationale, existing research provides mixed evidence with respect to the relationship between the board's gender structure and firm performance.[2]

There are three key theories that suggest that greater gender diversity may further contribute to better board effectiveness and performance: agency theory, resource dependency, and gender role theory (Terjesen et al. 2009).

From an agency theory perspective, Francoeur et al. (2008: 84) suggest that "women (like external shareholders, ethnic minorities, and foreigners) often bring a fresh perspective on complex issues, and this can help correct informational biases in strategy formulation and problem solving." A recent Finnish study reports that female board members are, compared to their male counterparts, more likely to take active roles on their boards (Virtanen 2012). Other work indicates that women are more likely to ask questions (Bilimoria and Wheeler 2000), debate issues (Ingley and Van der Walt 2005), display participative leadership and collaboration skills (Eagly and Johnson 1990), and generally hold their organizations to higher ethical

[2] Erhardt et al. (2003), Carter et al. (2003), Campbell and Mínguez-Vera (2008, 2010), Carter et al. (2010), Kang et al. (2010), Gul et al. (2011) and Mahadeo et al. (2012) Lükerath-Rovers (2013), Ntim (2013), among others, report a positive relationship between gender-diversified boards and firm performance. Sun et al. (2011) find no association between gender diversity of independent audit committees and the ability to constrain earnings management. Similarly, Kang et al. (2007) find no relationship. The lack of consistent findings may be due to prior studies' limited and non-harmonized measures of firm performance and lack of control variables. A meta-analysis of over eighty studies finds some support for gender (Post and Byron 2015). A more recent stream of research examines female CEOs and Chairs, finding a positive relationship to performance (Peni 2014).

standards (Pan and Sparks 2012). Women's ability to influence board decisions increases with their numbers, particularly boards with more than one woman (Fondas and Sassalos 2000) or three women (Konrad and Kramer 2006; Torchia et al. 2011). There is other evidence that boards with more women have greater levels of public disclosure (Gul et al. 2011), better oversight of management reporting that enhances earnings quality (Srindhi et al. 2011), and more board development evaluations and programs (Nielsen and Huse 2010). Female board members are more prepared for meetings (Pathan and Faff 2013) and attend more board meetings (Adams and Ferreira 2009). High levels of oversight are expected to lead to better performance outcomes.

Resource dependency theory is a second guiding perspective as female directors bring unique and valuable resources and relationships to their boards. In the case of networks, early work revealed that compared to male managers, female managers generally have more diverse networks (Ibarra 1992, 1993). More recent work on Italian directors suggests that female directors' networks are defined by the important role of families and that when women grow their networks over time, female directors do not possess a very high position in a global network of interlocking directors except in those cases of a female director on a family firm (Drago et al. 2011). Taken together with other research, there is evidence that women may understand certain markets and consumers better than their male counterparts (Arfken et al. 2004). Prior research also indicates that female directors are more likely to have non-business backgrounds that include a portfolio of experience (Hillman et al. 2002; Singh et al. 2008). This diversity of perspectives can enhance overall creativity and innovation with respect to problem solving.

Gender role theory (Eagly 1987) suggests that an individual's gender determines his/her behavior and its effectiveness with respect to influence. Furthermore, the theory suggests that males and females' behavior are assessed in terms of how it ascribes (or diverges) from expectations of the respective gender. Individuals who use tactics that are aligned to their gender tend to be perceived better by others (Eagly et al. 1995). Gender role theory describes how men and women have normatively prescribed behavior with respect to communication, including influence tactics. For example, women are expected to ascribe to more feminine roles such as sympathy and gentility (Eagly 1987). By contrast, men are expected to be more assertive and aggressive. Another gender role associated with women is flexibility which leads to a greater ability to manage ambiguous situations (Rosener 1995). Gender roles are relevant for the board as directors must use communication tactics that are effective in terms of influence. Furthermore, gender roles are particularly salient in male-dominated realms (Alderfer and Smith 1982) such as the board of directors where esteem is critical to effectiveness (Forbes and Milliken 1999). As such, we expect to see a positive relationship between the board gender diversity and firm performance:

Hypothesis 2 The greater the firm's proportion of female directors on its board, the better its performance.

2.3 Female directors, board independence and firm performance

This study's main hypothesis is that the composition of a board of directors will impact firm performance. As argued in Hypothesis 1, boards with greater shares of outside directors should be viewed more positively by the public than a board comprised of fewer outsiders. However, when the level of outsiders is fixed, the percentage of women on the board may be important when assessing outsiders' perceived independence. That is, regardless of the number of outsiders, a shareholder (or any stakeholder) can reasonably suspect that a board composed mainly of men is more closely aligned with the executive management than is a gender-diverse board. A large board of directors with few women directors may be interpreted as being selected by the executive management network or as a sign that internal agents (executive officers) wield significant power over the selection of outside agents. In reality, a board with a gender imbalance may be independent of the executive management to the same degree as a gender-diverse board, but the lack of women increases doubts from appointed directors, shareholders, and any stakeholders who interact with the firm regarding the board's independence.

These stakeholders' perceptions have implications at various levels of the firm. First, at the shareholder level, this perception leads to a lack of confidence in the efficacy of outside directors as monitors of executives. Moreover, it signals that the CEO has some power over the selection of the board and thus is entrenched and costly to replace. It may also signal that the CEO is performing poorly and using his/her bargaining power to maintain a friendly board to avoid being criticized or fired (Hermalin and Weisbach 1998). At the board level, outside directors view their colleagues as aligned with executives and less motivated to 'swim against the tide' (and thus provide valuable advising and monitoring services) (Faleye et al. 2011). Furthermore, to protect his/her career, a director may be unwilling to cause trouble for the CEO because of the perceived power of the CEO in the market for directors. Perhaps most importantly, employees, suppliers, customers, and virtually all other stakeholders will see the board as 'friendly,' influenced by internal agents who wish to circumvent legal requirements for a minimum number of outside independent directors. An inability to provide these signals will cause the stakeholders to view management as self-serving agents and be less willing to share the firm's goals. For example, employees will see a gender-imbalanced board as one that is selected based on the network hypothesis, indicating that the firm does not value the success of its women. In sum, the board's gender composition is an issue of business ethics. Establishing a(n) (im)balanced gender board sends an (un)ethical signal to the stakeholders, which negatively (positively) affects the board's effectiveness and the firm's performance. As such, we conjecture that gender diversity might enhance the independence of the board and improve its efficiency (Fig. 1). Taken together, we expect:

Hypothesis 3 Ceteris paribus, the positive effect of independent directors on firm performance is higher when the board is comprised of a greater proportion of female directors.

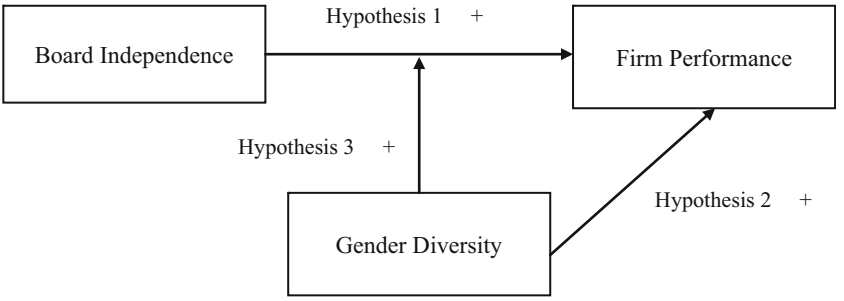

Fig. 1 Model of hypotheses

3 Data and methodology

We collected accounting, stock market, and corporate governance data from 3,876 listed companies in 47 countries in 2010 (see Table 1 for sample descriptives). By including firms in countries with different institutional environments, we increase the heterogeneity of the dependent variables, and therefore also the robustness and generalization of the results. Overall, the average number of females directors is less than 1 (.90) and average number of independent directors is 5.40.

3.1 Variables

3.1.1 Dependent variable

We use two proxies for firm performance: *Tobin's Q* (a market valuation indicator) and *return on assets* (ROA) (an accounting-based indicator). Both variables come from the Bloomberg database which computes and discloses financial information on listed companies worldwide.

Tobin's Q has been extensively used in the empirical literature as a proxy for firm performance (e.g., Agrawal and Knoeber 1996; Amman et al. 2011; Anderson and Reeb 2003; Barnhart and Rosenstein 1988; Carter et al. 2003; Combs et al. 2005; Florackis et al. 2009; Ikäheimo et al. 2004; Lefort and Urzúa 2008; Maury 2006; Kim and Lim 2010, among others). Tobin's Q is defined as the sum of total assets less the book value of equity plus the market value of equity, divided by total assets and provides an indication of the firm's expected performance. A Tobin's Q greater that one means that the shareholders believe the company is worth more than its book value; a value smaller than one means that the market is expecting the company to destroy shareholders' value in the future.

ROA is the ratio of net income to the book value of the firms' assets, and is commonly used in studies of board composition and firm performance (e.g., Easterwood et al. 2012). Since we are using a data set that includes only listed companies, these firms are generally obliged to adopt International Financial Reporting Standards (IFRS) or U.S. generally accepted accounting principles

Table 1 Sample characteristics

Country	# of firms	Average # of directors	Average # of female directors	Average # of independent directors
Australia	294	6.84	0.65	4.46
Austria	12	12.67	1.00	8.67
Belgium	18	11.83	1.17	4.89
Brazil	15	9.53	0.60	3.87
Canada	233	9.83	1.06	7.63
China	292	8.86	0.80	3.65
Colombia	1	9.00	1.00	6.00
Cyprus	1	15.00	1.00	6.00
Denmark	21	8.81	0.90	4.38
Estonia	3	6.33	0.00	2.67
Finland	39	7.56	1.67	6.00
France	83	12.86	1.64	6.55
Germany	27	13.44	1.07	8.37
Greece	6	12.67	0.83	4.00
Hong Kong	56	11.75	1.04	4.54
Hungary	1	9.00	0.00	6.00
India	438	8.22	0.36	4.35
Indonesia	2	6.00	0.00	2.50
Ireland	23	11.30	1.17	7.43
Israel	3	10.67	1.33	5.67
Italy	35	14.00	0.77	7.46
Japan	543	9.97	0.09	1.38
Lithuania	1	7.00	2.00	2.00
Luxembourg	6	9.83	1.33	5.33
Malaysia	15	9.33	0.87	4.00
Mexico	2	11.50	0.00	7.50
Netherlands	34	7.68	0.85	6.12
New Zealand	10	7.70	0.70	5.10
Norway	17	9.24	3.35	5.59
Pakistan	7	10.00	0.14	4.71
Papua New G.	1	9.00	0.00	7.00
Philippines	5	11.00	0.20	2.40
Portugal	8	16.63	0.63	6.63
Russia	13	10.85	0.69	4.23
Singapore	41	9.63	0.76	5.76
South Africa	45	12.73	2.31	6.89
South Korea	19	7.11	0.11	3.21
Spain	31	14.06	1.58	5.81
Sri Lanka	8	8.13	0.50	3.63
Sweden	54	9.65	2.33	6.02
Switzerland	58	8.95	0.79	7.67

Table 1 continued

Country	# of firms	Average # of directors	Average # of female directors	Average # of independent directors
Taiwan	8	9.13	1.13	1.88
Thailand	8	12.25	1.00	5.50
Turkey	7	9.43	1.00	1.71
U. Arab Em.	5	7.00	0.20	3.20
U. Kingdom	326	9.10	0.86	5.11
United States	1,001	10.06	1.40	8.05
Total sample	*3,876*	*9.54*	*0.90*	*5.40*

This table reports per country means of firms' size of the boards of directors, the number of female directors, and the number of independent directors

(GAAP) when disclosing their accounts. As such, the issue of comparability between the ROA of different countries is negligible.

3.1.2 Independent variables

We use two independent variables: *percentage of independent directors* and *percentage of female directors*, both measured in terms of percentage of the board. When a company has a supervisory board and a management board, the board structure is defined in terms of the supervisory board.

3.1.3 Control variables

We follow prior research in including controls for board, firm, and country level. At the board level, we control *board size*, *number of board meetings*, and *CEO/chair duality* (e.g., Di Pietra et al. 2008; Finkelstein and D'aveni 1994; Florackis and Ozkan 2009). Large boards and frequent meetings may create burdensome coordination costs that allow more CEO influence (Jensen 1993). Prior research indicates that when the CEO is also the Board Chair, power is highly concentrated and independent directors are less able to effectively monitor executives (Yermack 1996; Carter et al. 2003; Coles et al. 2008; Duchin et al. 2010) and there are negative impacts on firm performance (Bhagat and Bolton 2008).

We also control for the firm's *debt-to-assets ratio*, *a dividends dummy*, *percentage of free-float*, *percentage of institutional ownership*, *insider ownership*, and *book value of assets*. *Sector* dummy variables are included to extract any potential sector bias. Our capital expenditures model includes all of these controls, as well as the *book value of the assets (log)* to control for investments in place and the *number of employees (log)* because capital-intensive firms can have less human capital and vice versa. Debt usage and dividends may mitigate agency problems (Easterbrook 1984; Jensen 1986). Moreover, firms with dispersed ownership may have free rider problems (Admati et al. 1994); however, institutional investors can be efficient monitors of management (Shin and Seo 2011) and are included to

control for shareholder activism calling for more women on the board (Farrell and Hersch 2005). Finally, there is evidence that larger firms have more entrenched managers who are more difficult to assess (Coles et al. 2008).

At the country level, women's appointments to boards may be subject to the institutional environment (Terjesen and Singh 2008). We control for *gross domestic product per capita (GDPPC)* and the *ratio of market capitalization to GDP* as developed countries with more advanced financial markets may have better corporate governance devices (Gugler et al. 2003). Several variables are logged to account for skewness in the data. We also include *working women %* (percentage of women in the workforce; source: World Bank) and *common law dummy*. Table 2 provides a description of each of these variables. Table 3 depicts the correlation matrix of the variables used in the analysis.

3.2 Methodology

We test our hypotheses with the generalized method of moments (GMM) (Hansen 1982) regression which directly computes standard errors that are robust to heteroskedasticity of unknown form (Wooldridge 2001, 2002).

Following Hermalin and Weisbach (2003), all board-related variables, including the percentages of women and independent directors on the board and board size, are assumed to be endogenously related to firm performance and are thus instrumented. The combination of instruments should be correlated with the endogenous variable being instrumented, but not with the error term (except throughout the endogenous variable). The natural choice would be to use the lagged levels of the endogenous regressors following the same rational of Arellano and Bond's (1991) dynamic model, as well as other potential exogenous variables to guarantee the validity of the instruments. We select the lag percentages of independent and female directors on the board (as of 2009 fiscal year end), the lag of the board size, the number of employees (log), and the country's working women index as the initial set of instruments. The model will then choose the best linear combination of these instruments for each instrumented independent variable. To determine whether these variables are endogenous, we apply the GMM C statistic (Baum et al. 2007). The results are rejected at any significance level, thus suggesting that board-related variables are endogenously related to firm performance. Furthermore, to assess the instruments' validity, we computed the Hansen's (1982) J statistic χ^2 test for each of the estimated models. The results strongly suggest that the set of instruments is valid.

4 Results

4.1 Independent and female directors

Tables 4 and 5 depict our main findings. Model 1 simultaneously considers the board's independence and gender structures. Models 2 and 3 investigate the effect of the share of female and independent directors on the firms' Tobin's Q and ROA. Model 4 analyzes the interaction. As 52 % of the firms have at least one female

Table 2 Variables

Variable	Description	# of obs.	Mean	Std. dev.	25th perc.	50th perc.	75th perc.
Panel A: board structure							
# women on board	Number of women on the firm's board of directors, as reported by the company	3,876	0.90	1.08	0.00	1.00	1.50
≥1 female director (dummy)	Dummy: 1 if the firm's board of directors has at least one female member; 0 otherwise	3,876	0.53	0.50	0.00	1.00	1.00
% women on board	Ratio: number of women to number of directors on the firm's board (board size)	3,876	8.95	10.45	0.00	7.69	15.38
# independents on board	Number of independent directors on the firm's board, reported by the company (independence is defined according by company's own criteria)	3,876	5.40	3.16	3.00	5.00	8.00
% independents on board	Ratio: number of independent directors to number of total directors (board size).	3,876	57.25	28.59	16.67	60.00	80.00
Board size	Total number of directors on the firm's board (if firm has supervisory and management boards, only total members of the supervisory board)	3,876	9.54	3.20	7.00	9.00	11.00
Board meetings	Number of board meetings held in 2010.	3,876	9.62	5.20	6.00	8.00	12.00
CEO/chair duality	Dummy: 1 if the company's Chief Executive Officer is also Board Chair; 0 otherwise	3,876	0.32	0.47	0.00	0.00	1.00
Panel B: firm specific							
Tobin's Q (log)	Log of the sum of total assets less the book value of equity plus the market value of equity, divided by total assets	3,876	0.34	0.49	6.72E−03	0.22	0.59
ROA (log)	Log of the firm's gross return on assets (ROA) (defined as one plus the ratio of the net income to the book value of the firm's assets)	3,874	0.05	0.11	0.01	0.04	0.08
Debt-to-asset ratio	Ratio of total book value of debt financing (short-, medium- and long-term debt) to total book value of the firm's assets	3,876	24.91	20.30	9.03	22.42	36.39

Table 2 continued

Variable	Description	# of obs.	Mean	Std. dev.	25th perc.	50th perc.	75th perc.
Dividends	Dummy: 1 if the company paid any dividends during 2010 and 0 otherwise	3,876	0.73	0.44	0.00	1.00	1.00
% free float	Percentage of the firm's shares that are freely traded, calculated as the total number of shares not held by any controlling shareholder divided by the total number of shares outstanding	3,876	72.88	26.48	51.17	81.58	97.49
% institutional ownership	Percentage of outstanding shares held by institutions	3,876	53.80	35.76	23.56	51.23	83.63
% insider ownership	Percentage of outstanding shares held by insiders	3,876	4.75	11.77	0.09	0.59	2.80
Capital expenditures (log)	Log of the value of the firm's purchases of (tangible) fixed assets, excluding purchases of investments during 2010	3,763	5.50	2.74	3.81	5.44	7.23
# of employees (log)	Log of the firm's total number of employees, as reported by the firm, in 2010	3,580	8.38	2.02	7.20	8.54	9.74
Revenue (log)	Log of the total value of firm's operating revenues, sales or turnover, as reported by the firm, during 2010	3,876	8.52	2.69	6.93	8.34	10.19
Assets (log)	Log of the book value of the firm's assets, as reported by the firm, at the end of 2010	3,876	21.79	2.26	20.54	21.91	23.15
Panel C: country specific							
GDP per capita (log)	Log of the per capita GDP (USD) of the country where the firm is based	3,876	10.06	1.21	7.30	10.67	10.76
Market cap.-to-GDP ratio (log)	Log of the total market capitalization divided by the gross domestic product	3,876	4.64	0.51	4.39	4.76	4.91
% working women index	Percentage of female participation in a country's labor force rate as of 2009	3,876	53.65	9.63	32.80	58.40	58.40

Table 2 continued

Variable	Description	# of obs.	Mean	Std. dev.	25th perc.	50th perc.	75th perc.
Common law	Dummy: 1 if the company is incorporated in a common law country and 0 otherwise	3,876	0.65	0.48	0	1.00	1

All data were obtained from Bloomberg except for the country-specific variables which were gathered from the World Bank. All values are in 2010 USD unless otherwise specified

Table 3 Correlations

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. # women on board	1										
2. ≥1 female director (dummy)	0.766***	1									
3. % women on board	0.935***	0.778***	1								
4. # independents on board	0.532***	0.525***	0.418***	1							
5. % independents on board	0.367***	0.419***	0.384***	0.823***	1						
6. Board size	0.350***	0.275***	0.135***	0.443***	−0.0615***	1					
7. Board meetings	−0.105***	−0.166***	−0.104***	−0.262***	−0.314***	−0.000272	1				
8. CEO/chair duality	−0.0237	−0.0591***	−0.0307	−0.0307	−0.0763***	0.0107	0.0643***	1			
9. Tobin's Q (log)	0.0803***	0.130***	0.111***	0.119***	0.210***	−0.0909***	−0.214***	−0.0974***	1		
10. ROA (log)	0.0342*	0.0347*	0.0399*	0.0336*	0.0361*	−0.00683	−0.136***	0.00728	0.317***	1	
11. Debt-to-asset ratio	0.0399*	0.0455**	0.0266	0.0694***	0.0262	0.106***	0.0178	−0.0539**	−0.0987***	−0.200***	1
12. Dividends	0.0653***	0.0451**	0.0182	0.00176	−0.152***	0.221***	0.0699***	0.0177	−0.0437**	0.151***	−0.0317
13. % free float	0.189***	0.206***	0.176***	0.348***	0.365***	0.0594***	0.0250	0.0961***	0.0515**	−0.00235	−0.0225
14. % institutional ownership	0.200***	0.257***	0.191***	0.345***	0.354***	0.0687***	−0.120***	−0.00382	0.196***	0.0944***	−0.0263
15. % insider ownership	−0.0846***	−0.0673***	−0.0417*	−0.0943***	−0.00761	−0.174***	−0.151***	0.00103	0.0663***	0.0300	−0.0455**
16. Capital expenditures (log)	−0.0286	−0.113***	−0.120***	−0.108***	−0.359***	0.375***	0.241***	0.137***	−0.176***	0.0278	0.161***
17. # of employees (log)	0.313***	0.267***	0.214***	0.307***	0.0600***	0.463***	0.00767	0.0695***	0.0163	0.102***	0.0486**
18. Revenue (log)	0.00220	−0.0857***	−0.0846***	−0.132***	−0.409***	0.386***	0.279***	0.183***	−0.234***	0.0449**	0.0553**
19. Assets (log)	0.342***	0.291***	0.211***	0.414***	0.128***	0.563***	0.133***	0.0458**	−0.123***	0.0127	0.0902***

Table 3 continued

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
20. GDP per capita (log)	0.147***	0.151***	0.138***	0.183***	0.175***	0.0688***	0.183***	0.112***	−0.000162	−0.0592***	−0.0830***
21. Market cap.-to-GDP (log)	0.131***	0.157***	0.133***	0.167***	0.245***	−0.0651***	−0.207***	−0.0722***	0.125***	0.0635***	−0.0785***
22. % working women index	0.236***	0.267***	0.265***	0.248***	0.338***	−0.0708***	−0.0642***	0.0161	0.258***	0.0547**	−0.0930***
23. Common law	0.172***	0.235***	0.175***	0.450***	0.558***	−0.0791***	−0.307***	−0.136***	0.175***	0.0289	0.00987

Variable	(12)	(13)	(14)	(15)	(17)	(18)	(19)	(20)	(21)	(22)
12. Dividends	1									
13. % free float	0.0264	1								
14. % institutional ownership	−0.0359*	0.488***	1							
15. % insider ownership	−0.0966***	−0.254***	−0.173***	1						
16. Capital expenditures (log)	0.323***	−0.0520**	−0.143***	−0.227***						
17. # of employees (log)	0.241***	0.169***	0.226***	−0.189***	1					
18. Revenue (log)	0.355***	−0.0401*	−0.121***	−0.224***	0.593***	1				
19. Assets (log)	0.245***	0.277***	0.258***	−0.259***	0.671***	0.517***	1			
20. GDP per capita (log)	0.0437**	0.524***	0.388***	−0.162***	0.164***	−0.00982	0.379***	1		
21. Market cap.-to-GDP (log)	−0.000456	0.148***	0.217***	0.0601***	−0.0324	−0.198***	0.0144	0.138***	1	
22. % working women index	−0.119***	0.345***	0.284***	−0.00593	0.0772***	−0.316***	0.181***	0.413***	0.219***	1
23. Common law	−0.123***	0.269***	0.419***	0.0669***	−0.125***	−0.430***	−0.0904***	0.0301	0.488***	−0.00415

This table reports Pearson correlations between the variables used in the analysis. Significance levels are computed as two tailed p values: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 GMM estimation of a multiple linear regression of Tobin's Q

Explanatory variables	Dependent variable: log (Tobin's Q)				
	(1)	(2)	(3)	(4)	(5)
% women on board[a]	0.0573***	0.0349***	–	–	–
	(6.330)	(7.741)			
% independents on board[a]	−0.0096***	–	0.0068***	−0.0207***	−0.0097***
	(−4.974)		(5.327)	(−4.794)	(−5.045)
% women × % independent[a]	–	–	–	0.0011***	–
				(5.227)	
≥ 1 female director (dummy)[a]	–	–	–		1.2584***
					(6.329)
Board size[a]	−0.1459***	−0.1013***	−0.1969***	−0.2226***	−0.1480***
	(−4.128)	(−4.010)	(−6.018)	(−4.728)	(−4.325)
Board meetings	−0.0185***	−0.0095***	−0.0155***	−0.0303***	−0.0113***
	(−4.586)	(−3.482)	(−4.461)	(−5.207)	(−3.051)
CEO/Chair duality	−0.0737***	−0.0688***	−0.0757***	−0.1741***	−0.0483*
	(−2.777)	(−3.323)	(−3.243)	(−4.632)	(−1.867)
ROA (log)	0.9524***	0.9758***	0.5729**	0.9450***	1.0441***
	(3.749)	(4.109)	(2.191)	(3.419)	(4.261)
Debt-to-asset ratio	0.0002	0.0000	−0.0006	0.0002	0.0001
	(0.314)	(0.023)	(−0.819)	(0.169)	(0.135)
Dividends	0.0362	0.0772***	0.1489***	0.0025	0.0011
	(1.032)	(2.783)	(4.899)	(0.054)	(0.031)
% Free float	−0.0003	−0.0015***	−0.0023***	−0.0014	−0.0000
	(−0.415)	(−2.670)	(−3.451)	(−1.529)	(−0.016)
% Institutional ownership	0.0012**	0.0016***	0.0018***	0.0015**	0.0007
	(2.417)	(4.148)	(4.401)	(2.373)	(1.337)
% Insider ownership	0.0001	0.0003	−0.0007	0.0000	0.0008
	(0.052)	(0.250)	(−0.523)	(0.022)	(0.501)
Assets (log)	0.0819**	0.0422	0.1558***	0.1438***	0.0554
	(2.303)	(1.596)	(4.897)	(3.208)	(1.595)
GDP per capita (log)	−0.0404**	−0.0376**	−0.0655***	−0.1000***	−0.0335*
	(−1.968)	(−2.375)	(−3.473)	(−3.691)	(−1.753)
Market cap.-to-GDP (log)	−0.0980***	−0.0309	−0.0195	−0.1056**	−0.0824**
	(−2.759)	(−1.350)	(−0.602)	(−2.276)	(−2.440)
Common law	0.1785***	−0.0240	−0.1196**	0.2215***	0.1075**
	(3.503)	(−0.723)	(−2.507)	(3.019)	(2.313)
Constant	0.6096*	0.4414*	−0.8652***	1.2935***	0.8927***
	(1.880)	(1.749)	(−3.886)	(2.680)	(2.637)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Observations	3,579	3,579	3,874	3,579	3,579
Wald χ^2	412.797	679.267	487.573	228.392	444.456
(p value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GMM C statistic $\chi^{2\,b}$	101.001	158.591	160.657	122.382	96.9996
(p value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 4 continued

Explanatory variables	Dependent variable: log (Tobin's Q)				
	(1)	(2)	(3)	(4)	(5)
Hansen's J χ^{2c}	0.760834	0.591412	1.67064	0.667229	1.00007
(*p* value)	(0.3831)	(0.4419)	(0.4337)	(0.4140)	(0.3173)

Heteroscedastic robust z statistics in parentheses

*, ** and *** refer to significance at the 10, 5 and 1 % levels, respectively. See Table 2 for variable definitions

[a] Instrumented with the following variables: lag % women on board, lag % independents on board, lag board size, number of employees (log), debt-to-equity ratio, working women index and revenue (log)

[b] H0: instrumented variables are exogenous

[c] H0: instruments are valid

director, model 5 analyzes the effect of a dummy variable with the value of 1 if the board has at least one female member while maintaining the variable share of independent directors.

Model 1 in Table 4 shows that when simultaneously considering the percentages of female and independent directors, the percentage of female directors is positively associated with Tobin's Q, but the percentage of independent directors is negatively related to Tobin's Q. Furthermore, *ceteris paribus*, a 1 % increase in female directors increases Tobin's Q by 5.7 %; a 1 % increase in independent directors reduces Tobin's Q by 0.9 %. If we assume that the model is correctly specified (i.e., linear), our results indicate that female directors' presence is more important to firm performance than is independent directors' presence.

We further explore the relationship between board structure and Tobin's Q in models 2 and 3. Both coefficients are positive and statistically significant, providing support for Hypothesis 1 and 2 that a firm's greater share of independent and female directors is associated with superior financial performance. The change in sign implies that there is a positive relationship between the percentage of female directors and the percentage of independent directors. Nevertheless, the marginal effect of female directors on Tobin's Q is much higher than that of independent directors, supporting the previous results indicating that a gender diverse board is more important to firm performance than is a board with independent directors. In model 2, a 1 % increase in female directors results in a 3.5 % increase in Tobin's Q. In model 3, a 1 % increase in the independent directors increases Tobin's Q by approximately 0.7 %. One possible explanation is that most countries require listed firms to maintain a non-optimal minimum percentage of independent directors (Coles et al. 2008). Further corroboration comes from model 4's interaction of the percentages of independent directors and of female directors.[3] The results show that

[3] This model does not include the variable percentage of female directors and the interaction term because they are highly correlated and it is impossible to interpret their segregated effects. The implication of dropping the percentage of female directors from this model is that we do not consider the individual effect of this variable on firm performance, which then leads to an omitted variable problem. The instrumental variable regression model (GMM) solves this problem and the estimated coefficients remain robust.

Table 5 GMM estimation of a multiple linear regression of ROA

Explanatory variables	Dependent variable: log (1 + ROA)				
	(1)	(2)	(3)	(4)	(5)
% women on board[a]	0.0024**	0.0019***	–	–	–
	(2.007)	(3.042)			
% independents on board[a]	−0.0002	–	0.0003***	−0.0004	−0.0000
	(−0.661)		(2.769)	(−0.873)	(−0.151)
% women × % independent[a]	–	–	–	0.0001*	–
				(1.711)	
≥ 1 female director (dummy)[a]	–	–	–	–	0.0374*
					(1.893)
Board size[a]	−0.0018**	−0.0015**	−0.0016**	−0.0018**	−0.0025***
	(−2.563)	(−2.566)	(−2.575)	(−2.403)	(−2.698)
Board meetings	−0.0019***	−0.0018***	−0.0021***	−0.0021***	−0.0017***
	(−4.039)	(−3.735)	(−4.652)	(−4.316)	(−3.587)
CEO/Chair duality	0.0053	0.0053	0.0053	0.0022	0.0063*
	(1.446)	(1.476)	(1.442)	(0.494)	(1.748)
Debt-to-asset ratio	−0.0008***	−0.0008***	−0.0008***	−0.0008***	−0.0008***
	(−4.361)	(−4.470)	(−4.700)	(−4.270)	(−4.302)
Dividends	0.0387***	0.0390***	0.0449***	0.0366***	0.0393***
	(9.014)	(9.097)	(9.721)	(7.583)	(8.745)
% free float	−0.0000	−0.0001	−0.0001	−0.0001	−0.0000
	(−0.294)	(−0.615)	(−1.247)	(−0.740)	(−0.403)
% institutional ownership	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***
	(4.751)	(4.740)	(5.252)	(5.035)	(4.635)
% insider ownership	0.0003	0.0003	0.0003	0.0003	0.0003
	(0.745)	(0.784)	(1.042)	(0.828)	(0.749)
Assets (log)	0.0018	0.0017	0.0032*	0.0018	0.0021
	(0.872)	(0.794)	(1.714)	(0.827)	(1.017)
GDP per capita (log)	−0.0141***	−0.0143***	−0.0139***	−0.0160***	−0.0145***
	(−4.997)	(−5.054)	(−4.508)	(−5.822)	(−5.215)
Market cap.-to-GDP (log)	0.0057	0.0069*	0.0083**	0.0070*	0.0064*
	(1.501)	(1.848)	(2.332)	(1.894)	(1.741)
Common law	−0.0098**	−0.0122***	−0.0143***	−0.0104**	−0.0134***
	(−1.991)	(−2.717)	(−3.136)	(−2.049)	(−2.727)
Constant	0.0945***	0.0881**	0.0542*	0.1271**	0.0899***
	(2.696)	(2.565)	(1.954)	(2.529)	(2.619)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Observations	3,579	3,579	3,874	3,579	3,579
Wald χ^2	636.480	640.845	559.085	609.242	564.336
(p value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GMM C statistic χ^2 [b]	7.63722	7.40141	3.15124	6.47187	6.40341
(p value)	(0.0220)	(0.0065)	(0.0759)	(0.0393)	(0.0407)

Table 5 continued

Explanatory variables	Dependent variable: log (1 + ROA)				
	(1)	(2)	(3)	(4)	(5)
Hansen's J χ^2 [c]	1.18949	0.749835	0.582977	3.01271	2.06776
(*p* value)	(0.7555)	(0.6873)	(0.7472)	(0.3897)	(0.5585)

Heteroscedastic robust z statistics in parentheses

*, ** and *** refer to significance at the 10, 5 and 1 % levels, respectively. See Table 2 for variable definitions

[a] Instrumented with the following variables: lag % women on board, lag % independents on board, lag board size, number of employees (log), debt-to-equity ratio, working women index and revenue (log)

[b] H0: instrumented variables are exogenous

[c] H0: instruments are valid

the board's independence structure has a positive and statistically significant effect on firm performance when the board is more gender diversified, thus supporting Hypothesis 3. In models 4 and 5, the coefficients are negative and statistically significant, suggesting that when a board has few or no women, the presence of independent directors is detrimental to firm performance. Taken together, our results indicate that a gender-imbalanced board signals to shareholders that management is less independent and more entrenched, resulting in lower firm market values.

With respect to the controls, ROA is positive and statistically significant. This result is expected because accounting profitability explains a significant fraction of shareholders' firm valuation (measured here as Tobin's Q). Furthermore, we find that large boards with many meetings and in which the CEO is also the Chair have lower valuations. Firms that pay dividends have greater firm values. However, we find no significant evidence regarding the relationship between the use of debt and firm value, as predicted by Jensen (1986). Higher levels of ownership performance are associated with lower levels of firm value, as predicted by the free-rider hypothesis (Admati et al. 1994). Consistent with Ferreira and Matos (2008), we find a positive relationship between institutional investors' ownership and Tobin's Q, supporting the view that institutional investors are effective monitors of executive management. Insiders' ownership has no effect on firm performance.

We find that larger firms have higher Tobin's Q values. With respect to country-level controls, the results do not support the view that countries with higher GDPPC and more developed financial markets have firms with higher values, as perceived by the shareholders. This may be because investors in developing countries have higher growth expectations and thus higher Tobin's Q values.

The effects of gender and independent board structure on ROA (see Table 5) are similar to those for Tobin's Q (Table 4). When analyzed separately, the proportions of independent directors and female directors are both positively associated with ROA. Moreover, similar to the Tobin's Q results, the coefficient of the percentage of female directors is much higher than that of the percentage of independent directors (models 2 and 3 in Table 5); *ceteris paribus*, a 1 % increase in female directors results in a 0.2 % ROA increase; the same increase in independent

directors results in a 0.03 % ROA increase. Nevertheless, when a board has fewer or no female directors, the effect of independent directors is negatively associated with ROA (models 4 and 5).

Regarding the controls, similar to the Tobin's Q analysis, ROA is negatively affected by board size and the number of board meetings. We find a positive but not significant relationship to CEO/Chair duality, suggesting that a Chair who is not also the CEO has a greater effect on shareholders' confidence than on operating performance. Highly indebted firms are negatively associated with ROA. Similar to the Tobin's Q analysis, dividends are positively associated with a higher ROA. This suggests that dividends may be a good governance mechanism (Easterbrook 1984); however, there is no statistical relationship between ownership dispersion and operating performance. Institutional ownership is strongly positively associated with higher levels of firm operating performance, providing further evidence that institutional investors are good monitors of internal agents. We find no evidence that insiders' ownership affects operating performance. Firms with more assets are generally more profitable (higher ROA), but this effect is not statistically significant. Firms based in higher GDPPC countries have lower operating performance. Finally, there is a positive but not significant relationship between market development and ROA.

4.2 Female directors, board of directors and ownership features

Given the previous results, where we provide some evidence that women enhance the relationship between the independence of the board and firm performance, we now investigate the interrelationship between the percentage of female directors with other features of the board of directors and firm ownership. We are particularly concerned with the interaction between gender diversity and the variables: board meetings, CEO/chair duality, % free float, % institutional ownership, and % insider ownership. The arguments suggest that there is a positive impact of the interactions on firm performance as measured by Tobin's Q and ROA.

Tables 6 and 7 provide the results of these tests. As expected, in Table 6, the coefficients of all interaction terms are positive and statistically significant. This reveals that the negative association between the board size, number of meetings, and CEO/Chair duality to firm performance (measured by the firms' Tobin's Q) is mediated by the level of board gender diversity. Furthermore, the association between institutional ownership and insider ownership is highly dependent on the level of board gender diversity. The results provided in Table 7 are generally similar to Table 6, corroborating the view that the extent of a board's gender diversity plays an important role in explaining firm performance.

4.3 Determinants of female presence on corporate boards

Given our finding that independent directors' effectiveness depends on the board's gender composition, an important question is: What factors lead to females' appointments on boards of directors? Prior research indicates that larger boards and firms are more likely to have female directors (Bernardi et al. 2004, 2006; Sealy and

Table 6 Interactions analysis—dependent variable Tobin's Q (log)

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
% women × board size[a]	0.0058***					
	(6.287)					
% women × board meetings[a]		0.0052***				
		(6.252)				
% women × CEO/Chair duality[a]			0.1486***			
			(6.031)			
% women × % free float[a]				0.0008***		
				(5.946)		
% Women × % institutional own.[a]					0.0016***	
					(4.422)	
% women × % insider ownership[a]						0.0107***
						(3.445)
% independents on board[a]	−0.0096***	−0.0106***	−0.0097***	−0.0118***	−0.0157***	−0.0009
	(−4.917)	(−5.184)	(−4.741)	(−4.902)	(−4.017)	(−0.544)
Board size[a]	−0.1903***	−0.1333***	−0.0719*	−0.1823***	−0.2569***	−0.0291
	(−5.266)	(−3.875)	(−1.932)	(−4.677)	(−4.539)	(−0.382)
Board meetings	−0.0184***	−0.0631***	−0.0001	−0.0225***	−0.0317***	−0.0012
	(−4.663)	(−7.028)	(−0.031)	(−4.864)	(−4.581)	(−0.161)
CEO/chair duality	−0.0866***	−0.0041	−1.4536***	−0.1146***	−0.1675***	−0.1210**
	(−3.280)	(−0.141)	(−6.582)	(−3.772)	(−3.572)	(−2.259)
ROA (log)	0.9882***	0.9157***	0.9797***	0.8806***	0.9369***	1.4228***
	(3.871)	(3.574)	(4.037)	(3.354)	(2.940)	(3.778)
Debt-to-asset ratio	0.0008	−0.0002	−0.0001	0.0002	0.0010	0.0003
	(0.973)	(−0.254)	(−0.065)	(0.276)	(0.859)	(0.272)
Dividends	0.0468	0.0431	0.0554	0.0310	0.0753	0.1174*

Table 6 continued

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
	(1.402)	(1.219)	(1.352)	(0.785)	(1.273)	(1.871)
% free float	−0.0004	0.0006	−0.0014*	−0.0077***	−0.0010	0.0001
	(−0.570)	(0.848)	(−1.906)	(−5.878)	(−0.970)	(0.121)
% institutional ownership	0.0014***	0.0012**	0.0011**	0.0013**	−0.0131***	0.0012
	(2.998)	(2.393)	(2.064)	(2.305)	(−3.817)	(1.600)
% insider ownership	0.0004	0.0002	−0.0003	0.0002	0.0000	−0.0828***
	(0.275)	(0.163)	(−0.175)	(0.130)	(0.022)	(−3.135)
Assets (log)	0.0734**	0.0709**	−0.0009	0.1110***	0.1696***	−0.0057
	(2.119)	(2.028)	(−0.022)	(2.909)	(3.159)	(−0.071)
GDP per capita (log)	−0.0334*	−0.0132	0.0465**	−0.0266	−0.0491*	−0.0507
	(−1.678)	(−0.674)	(1.975)	(−1.268)	(−1.797)	(−1.082)
Market cap.-to-GDP ratio (log)	−0.1122***	−0.0767**	0.0037	−0.0900**	−0.1140**	0.0015
	(−3.013)	(−2.411)	(0.107)	(−2.387)	(−2.168)	(0.025)
Common law	0.1431***	0.1304***	−0.0532	0.1263**	0.1316*	0.1963**
	(2.952)	(2.741)	(−0.968)	(2.289)	(1.783)	(2.294)
Constant	1.1943***	0.8279**	1.0187**	0.8368**	0.9053*	0.7132
	(3.217)	(2.489)	(2.407)	(2.280)	(1.731)	(0.934)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,579	3,579	3,579	3,579	3,579	3,579
Wald χ^2	377.448	382.514	334.110	306.089	157.787	302.429
(*p* value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GMM C statistic χ^{2b}	121.415	124.648	134.063	125.926	120.712	131.895
(*p* value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table 6 continued

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Hansen's J χ^{2c}	0.808408	0.695258	0.278976	0.690288	.616388	0.576487
(*p* value)	(0.3686)	(0.4044)	(0.5974)	(0.4061)	(0.4324)	(0.4477)

Heteroscedastic robust z statistics in parentheses

*, ** and *** refer to significance at the 10, 5 and 1 % levels, respectively. See Table 2 for variable definitions

[a] Instrumented with the following variables: lag % women on board, lag % independents on board, lag board size, number of employees (log), debt-to-equity ratio, working women index and revenue (log)

[b] H0: instrumented variables are exogenous

[c] H0: instruments are valid

Table 7 Interactions analysis—dependent variable: 1 + ROA (log)

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
% women × board size[a]	0.0003***					
	(2.619)					
% women × board meetings[a]		0.0003***				
		(2.699)				
% women × CEO/chair duality[a]			0.0057**			
			(2.355)			
% women × % free float[a]				0.0000***		
				(2.581)		
% women × % institutional own.[a]					0.0001**	
					(1.997)	
% women × % insider ownership[a]						0.0004*
						(1.835)
% independents on board[a]	−0.0003	−0.0003*	−0.0003	−0.0004*	−0.0004	0.0000
	(−1.598)	(−1.701)	(−1.373)	(−1.656)	(−1.321)	(0.410)
Board size[a]	−0.0042***	−0.0017***	−0.0020***	−0.0022***	−0.0026***	−0.0016**
	(−3.308)	(−2.619)	(−2.807)	(−3.006)	(−2.860)	(−2.219)
Board meetings	−0.0019***	−0.0042***	−0.0015***	−0.0020***	−0.0022***	−0.0017***
	(−4.073)	(−4.442)	(−2.939)	(−4.321)	(−4.455)	(−3.358)
CEO/chair duality	0.0043	0.0085**	−0.0474**	0.0031	0.0016	0.0034
	(1.139)	(2.248)	(−2.079)	(0.803)	(0.366)	(0.835)
Debt-to-asset ratio	−0.0008***	−0.0008***	−0.0007***	−0.0008***	−0.0007***	−0.0007***
	(−4.256)	(−4.400)	(−4.185)	(−4.315)	(−4.107)	(−3.959)
Dividends	0.0389***	0.0381***	0.0385***	0.0367***	0.0385***	0.0423***
	(8.975)	(8.733)	(8.764)	(8.100)	(8.247)	(9.190)
% free float	0.0000	0.0000	−0.0001	−0.0004**	−0.0000	0.0000

Table 7 continued

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
	(0.056)	(0.455)	(−0.555)	(−2.304)	(−0.302)	(0.117)
% institutional ownership	0.0004***	0.0003***	0.0003***	0.0004***	−0.0002	0.0003***
	(4.827)	(4.563)	(4.128)	(4.681)	(−0.610)	(4.362)
% insider ownership	0.0003	0.0003	0.0002	0.0003	0.0004	−0.0025
	(1.062)	(0.912)	(0.706)	(1.015)	(1.103)	(−1.519)
Assets (log)	0.0014	0.0016	0.0017	0.0018	0.0023	0.0031
	(0.675)	(0.780)	(0.795)	(0.855)	(1.079)	(1.474)
GDP per capita (log)	−0.0138***	−0.0127***	−0.0115***	−0.0131***	−0.0141***	−0.0159***
	(−4.768)	(−4.235)	(−3.480)	(−4.422)	(−4.867)	(−5.150)
Market cap.-to-GDP ratio (log)	0.0044	0.0061*	0.0083**	0.0064*	0.0067*	0.0077**
	(1.140)	(1.681)	(2.285)	(1.744)	(1.778)	(1.979)
Common law	−0.0092**	−0.0097**	−0.0134***	−0.0110**	−0.0121**	−0.0042
	(−2.028)	(−2.167)	(−2.776)	(−2.406)	(−2.477)	(−0.748)
Constant	0.1262***	0.1060***	0.0917**	0.1166***	0.1204***	0.0672*
	(3.026)	(2.869)	(2.486)	(2.934)	(2.648)	(1.769)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,579	3,579	3,579	3,579	3,579	3,579
Wald χ^2	588.819	582.731	602.533	587.862	498.002	583.739
(p value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GMM C statistic $\chi^{2\,b}$	7.00186	6.38728	5.98307	6.07764	4.29923	4.75547
(p value)	(0.0081)	(0.0115)	(0.0144)	(0.0137)	(0.0381)	(0.0292)

Table 7 continued

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Hansen's J χ^2 [c]	2.08365	1.79756	3.06481	2.58808	4.78858	3.96886
(*p* value)	(0.7204)	(0.7729)	(0.5470)	(0.6289)	(0.3097)	(0.4102)

Heteroscedastic robust z statistics in parentheses

*, ** and *** refer to significance at the 10, 5 and 1 % levels, respectively. See Table 2 for variable definitions

[a] Instrumented with the following variables: lag % women on board, lag % independents on board, lag board size, number of employees (log), debt-to-equity ratio, working women index and revenue (log)

[b] H0: instrumented variables are exogenous

[c] H0: instruments are valid

Vinnicombe 2013). We expect that female directors are more prevalent in firms with more independent directors, a split of CEO and Chair roles, and a more complex firm environment, as measured by the log of the firm's assets, board size, number of employees, and Tobin's Q. We investigate the presence of female firms in terms of three variables: (1) dummy where 1 = board includes at least one woman and 0 = otherwise, (2) total number of female directors, and (3) percentage of female directors. We employ three models: (1) logit, (2) Tobit (left censored), and (3) Tobit (left and right censored) (see Table 7). We find that female representation is positively associated with the total number of independent directors, board size, and environmental complexity, and negatively related to CEO-Chair duality. Furthermore, larger boards are more likely to have female directors. All variables representing high levels of complexity in the firm's environment are positively associated with greater female board representation (Table 8).

With respect to the controls, debt financing is positively associated with greater female representation but is not significantly different from zero. Another interesting finding is that firms that pay dividends are more likely to have female directors, possibly because firms that pay dividends interact more with the financial market and are thus more motivated to provide signals about board effectiveness. There is no specific evidence as to whether institutional ownership and insider ownership promote gender-diversified boards. With respect to the country-level controls, firms in countries with more females in the labor market are more likely to have firms with female board members. Surprisingly, female representation on boards is not a characteristic of richer countries; rather, there is a negative relationship between a country's GDPPC and female board representation. Finally, firms in countries with more developed financial markets have more women on their boards. Again, this finding is consistent with the argument that a firm with more corporate governance concerns is more likely to pay attention to board gender structure.

4.4 Robustness checks

The previous analyses assume a linear relationship between board structure and firm performance; however, the effect of gender diversity on firm performance may vary by level of board independence. We re-estimate the regressions in Tables 4 and 5 for two groups of board structures: (1) an outsider-dominated board (>50 % independent) and (2) an insider-dominated board (<50 % independent). The results are generally maintained; however, the effect of the percentage of women on firm performance is stronger when the board is insider-dominated.

We also re-estimated the regressions for different levels of women's participation. As our sample has a significantly lower level of female directors, we conduct a sensitivity analysis with two groups: (1) firms with no or one female director and (2) firms with two or more female directors. The results hold, but the magnitudes of the effects of the percentages of female and independent directors are stronger when the board has fewer women.

Although we include many important industry and country level controls, other factors may impact firm performance. The estimated standard errors (which are

Table 8 Determinants of female participation on boards of directors

Explanatory variables	Model (dependent variable)		
	Logit [dummy (women on board)]	Tobit, left censored (# of women on board)	Tobit, left and right censored (% women on board)
% independents on board	0.03076***	0.01774***	0.18275***
	(8.974)	(4.298)	(5.354)
CEO/chair duality	−0.18525**	−0.11724**	−1.26536**
	(1.982)	(1.973)	(2.086)
Assets (log)	0.12905**	0.11875***	1.01347***
	(2.574)	(3.485)	(3.031)
Board size	0.23959***	0.17456***	0.85509***
	(11.957)	(14.463)	(7.663)
Employees (log)	0.17392***	0.15578***	1.55681***
	(4.798)	(5.648)	(5.617)
Tobin's Q (log)	0.17652*	0.16165***	1.55772**
	(1.849)	(2.582)	(2.299)
Debt-to-assets ratio	0.00321	0.00250	0.02882*
	(1.356)	(1.585)	(1.832)
Capital expenditures (log)	−0.19233***	−0.15287***	−1.49876***
	(6.404)	(5.650)	(6.146)
Dividends	0.34528***	0.15551**	1.77696**
	(3.199)	(2.312)	(2.495)
% institutional ownership	0.00100	0.00031	0.00112
	(0.679)	(0.323)	(0.112)
% insider ownership	−0.00281	−0.00205	−0.01486
	(0.717)	(0.723)	(0.478)
GDP per capita (log)	−0.17205***	−0.15240***	−1.40896***
	(3.352)	(4.320)	(3.837)
Market cap.-to-GDP ratio (log)	0.27847***	0.24290***	1.95542***
	(3.037)	(4.069)	(3.404)
% working-women index	0.03305***	0.02881***	0.29367***
	(5.195)	(6.474)	(6.407)
Constant	−8.73768***	−6.82055***	−55.71631***
	(9.670)	(10.488)	(8.753)
Industry dummies	Yes	Yes	Yes
Observations	3,490	3,490	3,490
Wald χ^2	675.69	–	–
(*p* value)	(0.000)		
F-Stat	–	56.33	44.26
(*p* value)		(0.000)	(0.000)
Pseudo R^2	0.2860	0.1632	0.0686

Heteroscedastic robust z statistics in parentheses

*, ** and *** refer to significance at the 10, 5 and 1 % levels, respectively

robust to heteroscedasticity of unknown form) are more accurate when clustered in countries and industries, although the coefficient estimates remain the same and continue to be efficient (Wooldridge 2002). To address this potential improvement, we re-estimate all models with z statistics computed from standard errors clustered by country and industry. The results are generally the same: the board composition z statistics (the percentage of female directors and independent directors) are still highly significant, however other controls, particularly country-level, reveal significantly lower z statistic values.

Finally, we conduct two sensitivity tests: (1) we re-estimate the models by excluding financial firms because banks may be subject to different forces that mediate firm performance; and (2) we exclude all observations from the United States and the United Kingdom.[4] The estimates reveal robust and qualitatively similar results.

5 Discussion

Taken together, our research raises a number of important issues for policy, practice, and theory. Although some countries have realized the importance of gender-balanced boards of directors, the governance debate has given much more attention to boards' independence structures. That is, virtually all corporate governance codes address the need for firms to have boards composed of outside 'independent' directors, whereas only a few codes address boards' gender structure. Given this study's finding that a more gender-diversified board is likely to enhance its independence and effectiveness, corporate governance codes worldwide should give at least the same importance to gender diversity as they give to the structure of board independence. In fact, acknowledging the role of women in corporate governance best practices can potentially increase the effectiveness of independent directors as it decreases the negative signal of an unbalanced gender board. We stress, however, that the results reported do not suggest that board independence is irrelevant. The empirical results merely indicate that board independence becomes secondary when gender diversity is not addressed.

Thus, in terms of practical implications, this paper supports the notion that gender diversity is an important corporate governance issue. In fact, if firms wish to provide correct signals regarding board effectiveness, they should also consider gender diversity. Exogenously requiring the addition of outside directors to a board does not necessarily lead to a more independent board. The qualitative aspects of the board independence and effectiveness such as gender diversity should also be considered when analyzing the board independence and effectiveness. Our results also support the notion that gender diversity might act as a substitute for board independence.

From a theoretical perspective, our findings suggest that a multi-theoretical lens explanation can be quite powerful. We find support for theories of agency, resource dependency, upper echelons, and gender roles.

[4] We thank a reviewer for this suggestion.

Before concluding, we wish to acknowledge four limitations that point to future research directions. First, given the cross-sectional data, panel studies with longer time spans would provide greater insights into the proposed relationships. Unfortunately, this data is not available for a significant number of countries. Future research could examine one particular country's firms and the evolution of the share of gender board diversity over time. This line of research could consider the impact of the speed and scope of gender board quota regulations on firm performance and other outcomes. Second, further research should classify female directors as independent and non-independent, extending research by Zelechowski and Bilimoria (2004). This data was also unavailable for the large number of countries in the present analysis. This work could be extended by considering directors who may be classified as independent but who are actually affiliated with the firm through prior employment or ongoing business. Third, our findings would benefit from considering different types of governance models, such as the one-tier system in which executive managers are part of a firm's board of directors of the two-tier system which includes supervisory and management boards. Investigating this knowledge void could advance our understanding of comparative corporate governance systems. Fourth, while we included many important controls, several of which were omitted in prior studies, other factors may influence financial performance. For example, firm age as unavailable in our data. Future research should consider firm age as there is considerable evidence of differences in corporate governance structures and performance between new ventures and larger, established counterparts (Gabrielsson and Huse 2004).

Finally, our study suggests several promising avenues for future research. First, researchers could investigate other types of board diversity (e.g., education and work background, ethnicity, age). This research could meaningfully extend our study of observable (gender) and non-observable (independence) diversity by examining other combinations of diversity. The concept of faultlines (Lau and Murnighan 1998) may be useful here as a group such as a corporate board can be divided along several lines. For example, following the gender board quotas in Norway and Spain, the new directors were more likely to be female, younger, and possess a graduate degree (Ahern and Dittmar 2012; González Menéndez and Martínez González 2012). Second, firm performance could be measured in non-financial terms, e.g., social performance in terms of the pipeline of women and minority managers (e.g., Bilimoria 2006) or environmental sustainability practices or other social responsibility practices. This line of enquiry would extend the present focus of the 'business case' on financial performance to other firm outcomes which are relevant to society. Third, longitudinal research could examine the human capital, social capital, and other resources that independent and female directors contribute to their boards. This analysis would shed light on how directors build meaningful stocks of resources from the initial venture through various firm stages such as initial public offering or acquisition. Fourth, researchers could access boardrooms (and other material normally outside the public domain) to examine how independent and female directors contribute to board governance processes. Building on work by Nielsen and Huse (2010), researchers could examine the interplay of power dynamics, gender roles, conflict, and agency. Future research

could also consider how strategic designs affect corporate governance (Shen and Gentry 2014), including the composition of the board.

6 Conclusion

This study examines the role of female directors in enhancing the independence and effectiveness of boards. Our results suggest that female directors send a positive signal to the public regarding a firm's ethical behavior. Firms with female directors have better financial performance. Furthermore, the positive firm performance effect of many independent directors is only positive if that board is also gender diversified. This evidence is important because recent studies questioned whether board independence improves performance. Our study also offers new insights into the determinants of greater female presence on boards. We find that firms with concerns about board independence and effectiveness and those operating in complex environments are more likely to have female directors. Virtually all national corporate governance codes address the need for boards to be composed of independent directors; yet only sixteen national codes and thirteen national quotas address boards' gender structure. Our results indicate that board independence is secondary when gender diversity is not addressed- thus board gender diversity is an important corporate governance issue.

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