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Director gender and mergers and acquisitions ☆

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ABSTRACT

Does director gender influence CEO empire building? Does it affect the bid premium paid for target firms? Less overconfident female directors less overestimate merger gains. As a result, firms with female directors are less likely to make acquisitions and if they do, pay lower bid premia. Using acquisition bids by S&P 1500 companies during 1997–2009 we find that each additional female director is associated with 7.6% fewer bids, and each additional female director on a bidder board reduces the bid premium paid by 15.4%. Our findings support the notion that female directors help create shareholder value through their influence on acquisition decisions. We also discuss other possible interpretations of our findings.

1. Introduction

There is a new and growing body of literature documenting gender differences in corporate leadership. For example, Adams and Ferreira (2009) show that female directors have better board attendance records than male directors, and are more likely to join monitoring committees. Haslam et al. (2010) find that female directors among the FTSE 100 companies in the UK are not significantly associated with accounting performance, but are negatively associated with stock market performance. Using responses to mandated changes in Norwegian boards, Ahern and Dittmar (2012) find that the quota requiring greater female representation on corporate boards is negatively associated with firm performance. Matsa and Miller (2013) further show that the presence of more female directors on Norwegian corporate boards is associated with fewer employee layoffs, higher labor costs, and lower profits. Similarly, using plant-level data in the US, Tate and Yang (2012) find that female CEOs help cultivate more female-friendly corporate environments, with smaller wage gaps between genders.

In this paper, we examine whether the presence of female directors on corporate boards is associated with firms' tendencies to make acquisitions and with the bid premium paid. We then consider whether these associations are consistent with women

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being less overconfident than men (see the survey by Croson and Gneezy (2009) and earlier work by Lichtenstein et al. (1982) and Beyer (1990)). We also consider other gender-related behavioral traits, such as women being more effective monitors, that might explain the observed associations.

Mergers and acquisitions (M&As) are an ideal setting for investigating the implications of male versus female behavioral traits in the boardroom. First, takeovers are highly significant economic activities that often do not add shareholder value (see the survey by Andrade et al. (2001) and the recent evidence from Chen et al. (2007)). It is important to understand why so many deals fail, especially given their size and scope. For example, could bidder male CEOs' and directors' overconfidence result in too many acquisitions or in paying too much? Second, according to Lenney (1977), gender differences in overconfidence depend on the lack of clear and unambiguous feedback. Specifically, when feedback is "unequivocal and immediately available, women do not make lower ability estimates than men. However, when such feedback is absent or ambiguous, women seem to have lower opinions of their abilities and often do underestimate relative to men." M&A successes and failures are not easily or immediately identifiable due to their uniqueness, complexity, scale, and other factors that influence overall acquirer performance. It is thus expected that men will be more confident than women of their ability to make acquisitions. Third, unlike day-to-day operating decisions, M&As invariably involve intense board-level discussion requiring final approval, where individual directors can make a difference to the eventual decision. These arguments make M&As an excellent platform for asking the following: is there any association between female representation on corporate boards and (1) the acquisitiveness of such boards, and (2) the financial terms of acquisition, and are any such associations consistent with women being less overconfident than men?

Using close to 20,000 firm-year observations for the period 1997–2009, we show a negative and significant association between the fraction of female directors on a corporate board and the number of acquisition bids: companies with more women directors are less acquisitive than those with fewer women directors. In terms of economic significance, each ten percent of female directors on a board, corresponding to approximately one female director, is associated with a reduction in the number of acquisition bids by 7.6%. In addition to evidence on acquisitiveness, using data from over 450 acquisition bids for which information on the bidder and target firm and board characteristics is available, we find that female directors on a bidder board are negatively and significantly associated with the size of the bid premium. In terms of economic significance, each ten percent of female directors on a bidder board is associated with a lower bid premium of 15.4%.

We argue that the associations we uncover between director gender and initiation of M&As and between director gender and the bid premium are both consistent with bidder female directors having relatively lower overconfidence in the precision of their estimates of an acquisition and/or in their expected value of an acquisition. We cannot, however, go beyond demonstrating the associations and the consistency of these findings with women being less overconfident, and with other gender-based behavioral characteristics identified in other contexts. This is because our investigation shares similar endogeneity concerns to those faced in the majority of investigations relating to corporate boards (Adams et al., 2010; Hermalin and Weisbach, 1988, 1998). For example, one could argue that an entrenched CEO prefers a "quiet life" and thus chooses women board members whom they believe will be less acquisitive. Alternatively, perhaps a particular CEO is by nature an empire-builder and thus does not appeal to women board members who are less overconfident.[1] In these cases, the significant associations between the presence of female directors and bid initiations and between the presence of female directors and the bid premium are due to the omission of unobservable variables in the regressions. We take a three-pronged approach to addressing endogeneity in our empirical investigation: firm fixed effects, instrumental variables, and propensity-score matching. Our main findings are robust to the last two approaches, and become weaker after controlling for firm fixed effects because of small within-firm variations among the fraction of female directors.

In addition to relating our findings to lower female overconfidence, we also consider other possible interpretations. For example, could the associations we identify be caused by female directors being more effective monitors than male directors (Adams and Ferreira, 2009) and as such, being associated with fewer and better deals? Could the associations be due to diverse boards taking a longer time to deliberate and reach decisions (Milliken and Martins, 1996), leading to fewer and better deals? Our findings could also be driven by unobservable corporate cultures or CEO styles (Fiordelisi and Ricci, (2014–in this issue); Graham et al., 2013; Tate and Yang, 2012). After further investigation, we conclude that our findings of significant associations between the presence of female directors and bid initiations and bid premiums are consistent with some, but not all, of the above interpretations.

Our paper contributes to several strands of literature. First, our paper provides new evidence on whether and how personal or behavioral traits of corporate executives are related to corporate decisions, adding to the findings by Malmendier and Tate (2005, 2008), Adams and Ferreira (2009), Malmendier et al. (2011), Graham et al. (2013), Huang and Kisgen (2013), and Berger et al. (2014–in this issue). Second, our paper offers new perspectives on why and how mergers take place, as compared to earlier studies surveyed by Andrade et al. (2001) and Betton et al. (2008). Finally, our paper points out the possible consequences of social and political forces pressuring corporations to appoint a larger proportion of female directors, as examined by Agrawal and Knoeber (2001), Ahern and Dittmar (2012), and Matsa and Miller (2013).

The outline of the paper is as follows. The next section reviews the related literature on gender-based behavioral differences and develops our hypotheses. Despite an absence of prior work on the association between board gender diversity and M&As,

[1] Acquisitiveness due to CEO overconfidence differs from the conventional view of empire building (Jensen, 1986, 1988) in that CEOs may well believe they are acting in the shareholders' interest, and as such there may be no agency problems (see Malmendier and Tate, 2008).

studies of gender differences in other financial contexts provide the basis for the suggested associations we evaluate in this paper. Section 2 presents the results on the statistically and economically significant association between female directors and bid initiation, and relates the observed association to the lower overconfidence of female directors. Section 3 presents the results on the significant association between female directors and the bid premium, again consistent with females being less overconfident. Section 4 investigates other possible interpretations of the observed associations and implements additional robustness checks. Section 5 summarizes and concludes.

2. Literature review and hypothesis development

Our research is related to prior investigations of the effects of gender on behavior in general and in financial contexts in particular. The behavioral differences of women and men in general are non-controversial. As has been mentioned, women are generally viewed as being less overconfident/more cautious than men, behaviors that have been attributed to the greater investment made in reproduction and thereby in the survival of our species (see, for example, Knight (2002)).[2] This gender difference is evidenced by the typically safer play behaviors of girls, relative to boys, and by women's more cautious behaviors, relative to men, involving sex, recreational drug use, alcohol consumption, gambling, and driving, and in employment choices (see, for example, Sax (2005) and Sapienza et al. (2009)).

2.1. Literature on gender differences in finance

Compared to the effects of gender on general behaviors, studies of the effects of gender on financial behaviors show more varied results, with not every investigation identifying statistically or economically significant differences in behavior between the sexes.

Using data from the 1992 and 1995 Surveys of Consumer Finances, Sundén and Surette (1998) show that both gender and marital status significantly affect how individuals choose to allocate assets under defined-contribution pension plans. Using account data for over 35,000 households from a large discount brokerage, Barber and Odean (2001) document that men trade more frequently than women, and men's increased trading reduces their net returns compared to those of women.

With respect to professional money managers, using data from nearly 2000 mutual fund investors, Dwyer et al. (2002) find that female managers take less risk than male managers in their mutual fund investments. However, the observed gender difference in risk-taking is significantly attenuated after controlling for financial investment knowledge. In particular, Atkinson et al. (2003) find that male and female mutual fund managers appear similar in terms of fund performance, risk, and other fund characteristics after controlling for wealth and knowledge differences between them.

Using *Fortune 500* firms during the 1990s, Farrell and Hersch (2005) show that women tend to serve as directors on better performing firms, but they also document that there is no wealth effect associated with the announcement of a woman being added to the board. Using a cross-sectional sample of the boards of directors of 1024 publicly traded US firms, Adams and Ferreira (2009) show that female directors are less likely to have attendance problems at board meetings, and are more likely to serve on monitoring-related committees than are male directors. They further show that boards with more female directors are more likely to hold CEOs accountable for poor stock price performance. To address endogeneity concerns, Adams and Ferreira (2009) employ firm fixed effects and instrumental variable techniques. Using FTSE 100 companies in the period 2001–2005, Haslam et al. (2010) find that there is no association between women's presence on boards and measures of operating performance (return on assets and return on equity), while there is a negative association between women's presence on boards and stock-based measures of performance (Tobin's Q). Using a panel of over 2000 listed Chinese firms for the period 1999–2011, Liu et al. (2014–in this issue) find that firm performance is positively related to board gender diversity, especially to the presence of female executive directors.

Using a merged panel of directors and executives for large US corporations between 1997 and 2009, Matsa and Miller (2011) find a positive association between the fraction of female directors on the board in the previous year and the fraction of female top executives in the current year. Ahern and Dittmar (2012) examine the relation between board structure and firm value using a new law in Norway requiring that at least 40% of corporate board members be women. They find that the law led to a significant negative impact on firm value due to the new female board members' younger ages and lack of high-level work experience. Examining the same quota system in Norway, Matsa and Miller (2013) further show that firms affected by the quota experienced fewer layoffs and higher labor costs, leading to ultimately poorer performance. To establish a causal relation between board composition and firm performance, both Ahern and Dittmar (2012) and Matsa and Miller (2013) take advantage of the mandatory diversity requirement of Norwegian corporate boards.

Given that boards meet infrequently, the role of the board is most likely to be detectable in large, discrete corporate decisions requiring board approval, rather than in day-to-day operations. This observation motivates our focus in this paper on the possible association between female representation on corporate boards and merger and acquisition decisions.

[2] There is some evidence suggesting that corporate executives might differ from the lay population in psychological traits such as risk aversion. For example, using a survey of Swedish directors, Adams and Funk (2012) find that female directors are slightly more risk-seeking than their male colleagues. Graham et al. (2013) show that US CEOs are different from the general population in risk tolerance. However, the evidence does not necessarily suggest that corporate executives differ from the lay population in overconfidence because gender difference in risk aversion can be attributed to gender difference in overconfidence or to some other reasons (Croson and Gneezy, 2009). See footnote 3 for more detailed discussion on the relation between risk aversion and overconfidence.

Table 1
Summary statistics of the bid initiation sample. Our bid initiation sample consists of 19,634 firm-year observations during the period 1997–2009. The sample is retrieved from Compustat/CRSP and has available data on board characteristics from RiskMetrics. All firm characteristics are measured at the fiscal year-end prior to the bid announcement date. See the Appendix A for definitions of the variables. All percentages are in decimal format. Panel A presents the summary statistics. Panel B presents the summary statistics of average year-to-year changes in the fraction of female directors for the 2674 unique firms in our sample.

Panel A: summary statistics of the bid initiation sample

	N	Mean	Std Dev	5th percentile	Median	95th percentile
# bid initiations	19,634	0.571	1.314	0.000	0.000	3.000
Fraction of female directors	19,634	0.095	0.091	0.000	0.100	0.250
Board size	19,634	9.469	2.811	6.000	9.000	14.000
Fraction of independent directors	19,634	0.674	0.177	0.333	0.706	0.900
CEO being COB	19,634	0.622	0.485	0.000	1.000	1.000
Sales growth	19,634	0.131	2.738	−0.241	0.074	0.534
Tobin's Q	19,634	1.891	1.620	0.922	1.438	4.300
ROA	19,634	0.040	0.258	−0.120	0.044	0.181
Book leverage	19,634	0.237	0.192	0.000	0.223	0.567
Cash holdings	19,634	0.131	0.163	0.004	0.060	0.496
Market capitalization ($B)	19,634	7.636	24.288	0.154	1.607	30.099
Firm age	19,634	22.424	13.556	4.000	20.000	44.000
E-index	17,751	2.668	1.393	0.000	3.000	5.000
Blockholder ownership	18,319	0.089	0.065	0.000	0.087	0.165

Panel B: temporal changes in board gender diversity

	N	Mean	Std Dev	5th percentile	25th percentile	Median	75th percentile	95th percentile
Average year-to-year change in fraction of female directors	2674	0.005	0.044	−0.052	0.000	0.000	0.000	0.097

2.2. Our hypotheses

We start our investigation by pointing out a general tendency of women to be less overconfident than men.[3] Overconfidence typically takes one of two forms. The first concerns the perceived precision of beliefs about future uncertain events (see, for example, Barber and Odean (2001)): women tend to view their predictions of how the future will unfold as less precise than men do. The second form concerns the level of expectations of what will happen (see, for example, Malmendier and Tate (2005, 2008)): women tend to see future outcomes in less favorable terms than men do. Whichever form overconfidence takes, the less overconfident attitudes of women are associated with a relative reluctance to undertake difficult, risky tasks lacking fast, clear feedback (Barber and Odean, 2001; Lenney, 1977).

We investigate first whether there is a negative relation between the number of female directors serving on corporate boards and the number of acquisitions. This will be true if, ceteris paribus, the same acquisition is seen as less attractive to women due to lower overconfidence about acquisitions in either or both of the forms described above. Hence, we postulate the following hypothesis[4]:

H1. The fraction of female directors on a board is negatively associated with the propensity to initiate acquisition bids.

We also investigate whether the presence of women on bidder boards is associated with lower bid premiums for target firms that are acquired. In particular, the first form of overconfidence implies that female directors will apply a greater discount rate to future cash flows from an acquisition, while the second form implies that female directors will expect lower cash flows from an acquisition than their male counterparts. Either or both forms of women's lower overconfidence suggest a lower valuation of the target firm by female directors on a bidder board. Hence, we postulate the following hypothesis:

H2. The fraction of female directors on a bidder board is negatively associated with the size of bid premiums.

[3] Croson and Gneezy (2009) conclusively show that women are more risk-averse than men and offer three possible explanations: gender differences in emotional experiences of outcomes, in risk attitudes relating to confidence, and in the interpretation of a risky situation. Given that one reason for gender difference in risk aversion is gender difference in overconfidence, we lack the means to disentangle risk aversion and overconfidence in our empirical setting.

[4] Malmendier and Tate (2008) posit that the effect of CEO overconfidence on corporate acquisitiveness is stronger in firms with larger cash holdings, because overconfident CEOs who overestimate values of their own firms are unwilling to resort to external financing. Their results (in Table 3) show that the overconfidence effect is statistically significant in cash-poor firms and is not significantly different from that in cash-rich firms. Further, firms with overconfident CEOs could be expected to hold more cash because their CEOs are more likely to make acquisitions, leading to endogenous holdings of cash. We thus leave the potential role of cash holdings in the effect of female directors on acquisitiveness for future research. For the same reason, we do not examine the effect of female directors on the method of payment in acquisitions and leave it for future research.

Table 2
Female directors and bid initiation. Panel A columns (1) and (2) present the Negative Binomial regression results for the number of bid initiations and column (3) presents the Negative Binomial regression results for firms with female directors and their propensity-score-matched control firms. Panel B presents the two-stage instrumental variable regression results. In the first stage OLS regression, the fraction of female directors is regressed on the instrumental variable and other controls. In the second stage Negative Binomial regression, the number of bid initiations in a year is regressed on the predicted fraction of female directors based on the first-stage estimation and other controls. See Table 1 and the Appendix A for the description of our sample and definitions of the variables, respectively. All model specifications employ robust standard errors, which are reported in the parentheses below each coefficient. Superscripts ***, **, and * correspond to statistical significance at the one-, five-, and ten-percent levels, respectively.

Panel A: explaining bid initiation

	# bid initiations		
	(1)	(2)	(3)
Fraction of female directors	−0.7901***	−0.3576	−0.7239**
	(0.299)	(0.262)	(0.356)
Board size	−0.0078	−0.0108	0.0032
	(0.010)	(0.008)	(0.011)
Fraction of independent directors	−0.1669	0.1075	0.1255
	(0.145)	(0.121)	(0.212)
CEO being COB	0.0268	−0.0136	0.0027
	(0.047)	(0.034)	(0.061)
Sales growth	−0.0016	0.1557***	−0.0252
	(0.011)	(0.039)	(0.039)
Tobin's Q	−0.0102	−0.0245***	−0.0332
	(0.011)	(0.007)	(0.027)
ROA	0.1009	0.0935	0.4834*
	(0.085)	(0.094)	(0.290)
Book leverage	−0.2622*	−1.1232***	0.0054
	(0.143)	(0.152)	(0.193)
Cash holdings	−0.3001*	1.3748***	−0.2032
	(0.168)	(0.167)	(0.227)
Logarithm of market capitalization	0.3365***	0.3625***	0.3265***
	(0.017)	(0.027)	(0.023)
Constant	−3.0859***	−2.0047***	−3.4710***
	(0.428)	(0.456)	(0.501)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes
Firm fixed effects	No	Yes	No
Cluster by firm	Yes	No	Yes
Observations	19,634	19,634	23,370
McFadden's adjusted R-squared	0.080	0.126	0.097

Panel B: explaining bid initiation: instrumental variable regressions

	Fraction of female directors	# bid initiations
	(1)	(2)
Fraction of female directors		−4.6951**
		(2.237)
Fraction of male directors linked to female directors	0.0471***	
	(0.005)	
Board size	0.0033***	0.0066
	(0.001)	(0.013)
Fraction of independent directors	0.0791***	0.2157
	(0.008)	(0.265)
CEO being COB	0.0043*	0.0441
	(0.002)	(0.047)
Sales growth	−0.0003	−0.0028
	(0.000)	(0.011)
Tobin's Q	−0.0007	−0.0142
	(0.001)	(0.011)
ROA	0.0067*	0.1245
	(0.003)	(0.083)
Book leverage	0.0128*	−0.1917
	(0.008)	(0.148)
Cash holdings	−0.0059	−0.3441**
	(0.009)	(0.168)
Logarithm of market capitalization	0.0070***	0.3756***
	(0.001)	(0.030)
Constant	−0.0809***	−3.4349***
	(0.024)	(0.487)
Year fixed effects	Yes	Yes

(continued on next page)

Table 2 (*continued*)

Panel B: explaining bid initiation: instrumental variable regressions		
	Fraction of female directors	# bid initiations
	(1)	(2)
Industry fixed effects	Yes	Yes
Cluster by firm	Yes	Yes
Observations	19,353	19,353
Adjusted/McFadden's adjusted R-squared	0.242	0.081

3. Gender diversity and bid initiations

This section specifies the bid initiation model, describes the sample, and examines the association between the fraction of female directors and the number of bid initiations.

3.1. Model specification

To explore the association between board gender diversity and the initiation of M&As, i.e., acquisitiveness, we run the following Negative Binomial regression focusing on the fraction of female directors on a board:

$$\begin{aligned}\text{Log}(\text{Bid initiation}_{it}) = {} & \alpha_0 + \beta_1 \text{Fraction of female directors}_{it} + \beta_2 \text{Board size}_{it} \\ & + \beta_3 \text{Fraction of independent directors}_{it} + \beta_4 \text{CEO being COB}_{it} \\ & + \beta_5 \text{Sales growth}_{it} + \beta_6 \text{Tobin's Q}_{it} + \beta_7 \text{ROA}_{it} + \beta_8 \text{Book leverage}_{it} \\ & + \beta_9 \text{Cashholding}_{it} + \beta_{10} \text{Firm size}_{it} + e_{it}.\end{aligned} \tag{1}$$

where bid initiation is the number of acquisition bids made within a fiscal year. The number of bid initiations is an over-dispersed count variable, whose variance is significantly greater than its mean (see Table 1). In this case, the Negative Binomial regression will produce consistent estimation results (Cameron and Trivedi, 1998).

The key explanatory variable of interest is the measure of board gender diversity in sample firms. The controls for firm characteristics are motivated by Byrd and Hickman (1992), Shivdasani (1993), Martynova and Renneboog (2008), and Levi et al. (2010). We also control for year and industry fixed effects (based on Fama and French (1997) 48-industry classifications). Because standard errors may be underestimated in panel data sets such as ours, we present results based on standard errors clustered by firm (Petersen, 2009).

3.2. The bid initiation sample

To form the bid initiation sample, we start with firms covered by Compustat/CRSP and the RiskMetrics Group's corporate board and director database (covering member firms in the S&P 500 index, the S&P MidCap 400 index, and the S&P SmallCap 600 index—hence S&P 1500 firms). We then retrieve the acquisition bids initiated by these firms during the period 1997–2009 from the Thomson Financial's SDC database. We require an acquisition bid to take the form of a merger (SDC deal form M), an acquisition of majority interest (AM), or an acquisition of assets (AA). We include control bids only where the bidder's toehold before the deal announcement is less than 50%, and the sum of the toehold and the percentage ownership sought in the deal is more than 50%. The board and director information is taken from RiskMetrics at the most recent annual shareholder meetings before the bid announcement. Our final bid initiation sample consists of 19,634 firm-year observations.

Panel A in Table 1 presents the descriptive statistics of the variables. The average number of acquisition bids initiated by a firm in a year is 0.57. The number of bid initiations is over-dispersed with a variance of 1.73. About 70% of the firm-years have no bid, 18% have one bid, and 6.5% have two bids (untabulated). The average corporate board consists of 9.5 members, of which 9.5% are women and 67% are independent outsiders. These numbers are slightly higher than those reported in the study by Farrell and Hersch (2005), showing that female directors comprise 8.6% of board members in a sample of *Fortune 500* firms, and in the study by Paul (2007), showing that independent directors comprise 53% of board members in a sample of M&A deals over the period 1982–1996.

In our sample, about 62% of the CEOs are also chairmen of their respective boards. The average sales growth is 13%; Tobin's Q 1.9; return on assets 4.0%; and book leverage 24%. On average, 13% of the firms' assets are in the form of cash or short-term investments. The firms have an average market capitalization of $7.6 billion, and have been included in the CRSP/Compustat database for an average of 22 years. In terms of corporate governance measures, the firms have an average E-index of 2.7 (out of 6), and an average blockholder ownership of 8.9%.

The correlation matrix of the variables (not shown for reasons of brevity) reveals that the fraction of female directors on a corporate board is positively but insignificantly correlated with the number of acquisition bids. Examination of the correlation matrix more generally suggests little problem of multicolinearity. Given that omitted variable bias in univariate correlations can mask the true relations between the variables, we next employ multiple regressions to examine the factors associated with corporate acquisitiveness.

Table 3
Summary statistics of the merger and acquisition sample. Our merger and acquisition sample consists of 458 deals announced during the period 1997–2009. The data are retrieved from the SDC database and have available information on the firm and board characteristics of both bidder and target firms from Compustat/CRSP/RiskMetrics. All firm characteristics are measured at the fiscal year-end prior to the bid announcement date. See the Appendix A for definitions of the variables. All percentages are in decimal format.

	N	Mean	Std Dev	5th percentile	Median	95th percentile
Bid premium	458	0.354	0.312	−0.016	0.305	0.917
Bidder fraction of female directors	458	0.107	0.078	0.000	0.100	0.250
Target fraction of female directors	458	0.080	0.082	0.000	0.083	0.222
Toehold	458	0.006	0.037	0.000	0.000	0.000
All cash	458	0.192	0.394	0.000	0.000	1.000
All stock	458	0.349	0.477	0.000	0.000	1.000
Bidder board size	458	11.282	3.728	7.000	11.000	18.000
Tender offer	458	0.151	0.358	0.000	0.000	1.000
Unfriendly	458	0.109	0.312	0.000	0.000	1.000
Transaction value ($B)	458	7.175	15.205	0.342	2.095	35.564
Relative size	458	0.320	0.365	0.008	0.208	1.090
Bidder fraction of independent directors	458	0.675	0.184	0.286	0.704	0.909
Bidder CEO being COB	458	0.758	0.429	0.000	1.000	1.000
Bidder sales growth	458	0.243	0.475	−0.128	0.126	0.909
Bidder Tobin's Q	458	2.262	1.998	1.053	1.603	5.595
Bidder ROA	458	0.056	0.175	−0.012	0.054	0.210
Bidder book leverage	458	0.252	0.166	0.000	0.241	0.540
Bidder firm age	458	26.260	13.152	5.000	29.000	45.000
Bidder E-index	435	2.241	1.386	0.000	2.000	4.000
Bidder blockholder ownership	458	0.068	0.062	0.000	0.072	0.151
Target board size	458	9.762	3.243	5.000	9.000	15.000
Target fraction of independent directors	458	0.672	0.172	0.333	0.692	0.900
Target CEO being COB	458	0.651	0.477	0.000	1.000	1.000
Target sales growth	458	0.148	0.350	−0.189	0.101	0.668
Target Tobin's Q	458	1.851	1.355	0.986	1.438	4.089
Target ROA	458	0.046	0.104	−0.069	0.041	0.181
Target book leverage	458	0.253	0.187	0.000	0.256	0.564
Target firm age	458	21.212	13.205	4.000	18.500	41.000
Target E-index	406	2.594	1.280	1.000	3.000	5.000
Target blockholder ownership	458	0.084	0.055	0.000	0.083	0.174

3.3. Female directors and bid initiation

Table 2 Panel A presents the Negative Binomial regression results where the dependent variable is the number of bid initiations. Column (1) shows that the fraction of female directors on the board is negatively and significantly associated with the number of bids at the one-percent level, consistent with our first hypothesis (H1). In terms of economic significance, each ten percent of female directors on the board, corresponding to approximately one female director, lowers the number of bids by 7.6% ($= 1 - \exp(-0.7901 \times 0.1)$). The first term in the exponential function is the coefficient on the fraction of female directors. We see that the presence of women on the board is negatively and meaningfully associated with the number of corporate acquisitions.

As noted earlier, our investigation shares the same endogeneity concerns as the majority of investigations relating to corporate boards. Consequently, we employ a three-pronged approach: firm fixed effects regression to help address the omitted variable problem, propensity-score matching to address selection based on observable firm characteristics,[5] and instrumental variable (IV) regressions to address reverse causality.

Panel A column (2) presents the firm fixed effects regression results. We show that the coefficient on the fraction of female directors remains negative but becomes statistically insignificant. It is worth noting that most firms in our sample experience little temporal change in gender diversity of their boards: on average, the fraction of female directors changes by 0.5% from year to year (see Table 1 Panel B). The lack of within-firm variation works against finding a significant effect of female directors on bid initiation in firm fixed effects regressions (Zhou, 2001).

Panel A column (3) presents the Negative Binomial regression results using sample firms with female directors and their propensity-score-matched control firms. To obtain the control sample, in each year over our sample period we run a probit regression where the dependent variable is an indicator variable for the presence of female directors, and the explanatory variables include sales growth, Tobin's Q, return on assets (ROA), leverage, cash holdings, and firm size, all of which have been shown to be associated with the presence of female directors on corporate boards (Adams and Ferreira, 2009; Farrell and Hersch, 2005; Kulich, Trojanowski, Ryan, Haslam, and Renneboog, 2011). We form the propensity-score-matched control sample yearly because the fraction of female directors has steadily increased, from about seven percent in the early 1990s to almost twelve percent by the late 2000s. For each sample firm with female directors, we choose one control firm without female directors on its board that has the closest propensity of having female directors. To allow for the potential effects of other firm characteristics on

[5] We thank an anonymous referee for suggesting the propensity-score matching approach to addressing selection based on observable firm characteristics.

acquisitiveness, we employ the regression approach of Lemmon and Roberts (2010), by regressing the number of bid initiations on the explanatory variables for the matched pairs. The results continue to show a negative and significant association between the presence of female directors and corporate acquisitiveness.

Panel B presents the results of the instrumental variable regression. We need an instrument that is correlated with the fraction of female directors on the board, but uncorrelated with M&As except through variables for which we control. Following Adams

Table 4
Female directors and the bid premium. Panel A presents the OLS regression results for the size of the bid premium. Panel B presents the two-stage instrumental variable regression results. In the first stage OLS regression, the fractions of female directors are regressed on the instrumental variables and other controls. In the second stage OLS regression, the bid premium is regressed on the predicted fractions of female directors based on the first-stage estimation and other controls. See Table 3 and the Appendix A for the description of our sample and definitions of the variables, respectively. All model specifications employ robust standard errors, which are reported in the parentheses below each coefficient. Superscripts ***, **, and * correspond to statistical significance at the one-, five-, and ten-percent levels, respectively.

Panel A: explaining the bid premium		
	Bid premium	
	(1)	(2)
Bidder fraction of female directors	−0.5406***	−0.4150
	(0.202)	(1.136)
Target fraction of female directors	0.1649	0.0989
	(0.226)	(0.598)
Toehold	−0.5424	1.0032
	(0.575)	(1.029)
All cash	0.0309	0.1069
	(0.048)	(0.126)
All stock	−0.0651*	−0.1133
	(0.034)	(0.091)
Tender offer	0.1598**	0.1757
	(0.063)	(0.123)
Unfriendly	0.0145	−0.0670
	(0.041)	(0.114)
Log transaction value	−0.0090	0.0482
	(0.016)	(0.061)
Relative size	−0.0145	−0.0869
	(0.042)	(0.165)
Bidder board size	0.0014	0.0023
	(0.005)	(0.022)
Bidder fraction of independent directors	0.0856	−0.1781
	(0.091)	(0.391)
Bidder CEO being COB	0.0106	0.0302
	(0.032)	(0.157)
Bidder sales growth	0.0493	0.0311
	(0.039)	(0.120)
Bidder Tobin's Q	0.0081	0.0059
	(0.008)	(0.037)
Bidder ROA	0.1543	−0.6270
	(0.096)	(0.856)
Bidder book leverage	−0.0760	−0.6537
	(0.111)	(0.559)
Target board size	−0.0058	0.0136
	(0.006)	(0.014)
Target fraction of independent directors	0.0732	0.0814
	(0.100)	(0.226)
Target CEO being COB	0.0132	−0.0065
	(0.035)	(0.079)
Target sales growth	−0.0747	0.0530
	(0.051)	(0.127)
Target Tobin's Q	0.0043	0.0050
	(0.015)	(0.046)
Target ROA	−0.2724	0.0409
	(0.195)	(0.525)
Target book leverage	0.0606	−0.1363
	(0.115)	(0.255)
Constant	0.5466***	0.1749
	(0.136)	(0.433)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	No
Firm fixed effects	No	Yes
Observations	458	458
Adjusted R-squared	0.168	0.289

Table 4 *(continued)*

Panel B: explaining the bid premium: instrumental variable regressions

	Bidder fraction of female directors	Target fraction of female directors	Bid premium
	(1)	(2)	(3)
Bidder fraction of female directors			−2.2407*
		(1.351)	
Target fraction of female directors			2.2191
		(2.375)	
Fraction bidder male directors linked to female directors	0.0567***	0.0271	
(0.017)	(0.017)		
Fraction target male directors linked to female directors	−0.0097	0.0356*	
(0.018)	(0.020)		
Toehold	0.0352	−0.0211	−0.8139*
(0.084)	(0.141)	(0.493)	
All cash	−0.0017	−0.0146	0.0665
(0.012)	(0.012)	(0.064)	
All stock	−0.0079	−0.0046	−0.0733*
(0.009)	(0.010)	(0.040)	
Tender offer	−0.0095	−0.0164	0.2100**
(0.011)	(0.013)	(0.081)	
Unfriendly	−0.0188	−0.0038	0.0001
(0.013)	(0.016)	(0.053)	
Log transaction value	0.0038	0.0096*	−0.0338
(0.004)	(0.005)	(0.041)	
Relative size	−0.0354***	0.0175	−0.1353
(0.012)	(0.015)	(0.092)	
Bidder board size	0.0033***	0.0008	0.0054
(0.001)	(0.001)	(0.006)	
Bidder fraction of independent directors	0.0560**	0.0139	0.1219
(0.024)	(0.027)	(0.122)	
Bidder CEO being COB	0.0140*	−0.0022	0.0390
(0.008)	(0.010)	(0.043)	
Bidder sales growth	−0.0207**	0.0010	0.0016
(0.009)	(0.010)	(0.054)	
Bidder Tobin's Q	−0.0019	−0.0032	0.0116
(0.002)	(0.003)	(0.013)	
Bidder ROA	−0.0155	0.0274	0.0311
(0.026)	(0.027)	(0.142)	
Bidder book leverage	0.0183	0.0104	−0.0012
(0.029)	(0.032)	(0.136)	
Target board size	−0.0004	0.0031**	−0.0148
(0.001)	(0.001)	(0.009)	
Target fraction of independent directors	0.0502**	0.0848***	−0.0150
(0.024)	(0.029)	(0.226)	
Target CEO being COB	−0.0105	0.0069	−0.0051
(0.008)	(0.010)	(0.041)	
Target sales growth	0.0124	0.0062	−0.0586
(0.014)	(0.013)	(0.053)	
Target Tobin's Q	0.0020	−0.0055	0.0273
(0.003)	(0.004)	(0.020)	
Target ROA	−0.0048	0.0215	−0.2608
(0.041)	(0.039)	(0.225)	
Target book leverage	−0.0356	0.0179	0.0185
(0.023)	(0.026)	(0.137)	
Constant	−0.0173	−0.1479***	0.9669**
(0.042)	(0.047)	(0.469)	
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Observations	451	451	451
Adjusted R-squared	0.322	0.248	0.168

and Ferreira (2009), our instrumental variable is the fraction of a firm's male directors who sit on other boards that have at least one female director. We expect this instrumental variable to be positively correlated with the fraction of female directors. In column (1), we regress the fraction of female directors on the instrumental variable and other controls. We show that the instrument is positively and significantly associated with the fraction of female directors at the one-percent level.

In column (2), we regress the number of bid initiations on the predicted fraction of female directors based on the estimates in column (1). The coefficient on the fraction of female directors remains negative and statistically significant at the five-percent

Table 5
Robustness checks. Panel A presents the Negative Binomial regression results for the number of bid initiations with additional control variables for firm age, the E-index, and blockholder ownership. Panel B presents the OLS regression results for the bid premium with additional control variables for firm age, the E-index, and blockholder ownership. See Tables 1 and 3 and the Appendix A for the description of our samples and definitions of the variables, respectively. All model specifications employ robust standard errors, which are reported in the parentheses below each coefficient. Superscripts ***, **, and * correspond to statistical significance at the one-, five-, and ten-percent levels, respectively.

Panel A: explaining bid initiation: additional controls			
	# bid initiations		
	(1)	(2)	(3)
Fraction of female directors	−0.7298**	−0.7952**	−0.7774**
	(0.295)	(0.313)	(0.310)
Board size	−0.0024	−0.0093	−0.0065
	(0.010)	(0.010)	(0.011)
Fraction of independent directors	−0.1271	−0.1813	−0.1696
	(0.148)	(0.154)	(0.153)
CEO being COB	0.0293	−0.0036	0.0208
	(0.047)	(0.048)	(0.049)
Sales growth	−0.0044	−0.0174	−0.0021
	(0.009)	(0.018)	(0.009)
Tobin's Q	−0.0146	−0.0094	−0.0083
	(0.011)	(0.020)	(0.011)
ROA	0.1252	0.3143	0.1003
	(0.089)	(0.248)	(0.086)
Book leverage	−0.2816**	−0.2364	−0.2879*
	(0.141)	(0.147)	(0.152)
Cash holdings	−0.3363**	−0.2962*	−0.4105**
	(0.170)	(0.178)	(0.176)
Logarithm of market capitalization	0.3445***	0.3410***	0.3354***
	(0.017)	(0.018)	(0.018)
Logarithm of firm age	−0.1014***		
	(0.037)		
E-index		0.0310*	
		(0.018)	
Blockholder ownership			−0.3291
			(0.445)
Constant	−2.9182***	−3.1683***	−3.0299***
	(0.430)	(0.458)	(0.436)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Cluster by firm	Yes	Yes	Yes
Observations	19,536	17,673	18,238
McFadden's adjusted R-squared	0.084	0.088	0.082
Panel B: explaining the bid premium: additional controls			
	Bid premium		
	(1)	(2)	(3)
Bidder fraction of female directors	−0.4598**	−0.4271*	−0.5327***
	(0.204)	(0.219)	(0.202)
Target fraction of female directors	0.1570	0.1960	0.1634
	(0.223)	(0.250)	(0.227)
Toehold	−0.5579	−0.5384	−0.5024
	(0.574)	(0.561)	(0.587)
All cash	0.0454	0.0271	0.0370
	(0.050)	(0.059)	(0.049)
All stock	−0.0643*	−0.0629	−0.0724**
	(0.035)	(0.038)	(0.036)
Tender offer	0.1565**	0.1359**	0.1548**
	(0.062)	(0.068)	(0.065)
Unfriendly	0.0174	0.0159	0.0098
	(0.041)	(0.043)	(0.040)
Log transaction value	0.0007	−0.0080	−0.0064
	(0.016)	(0.018)	(0.016)
Relative size	−0.0264	−0.0122	−0.0205
	(0.041)	(0.048)	(0.044)
Bidder board size	0.0032	0.0002	0.0019
	(0.005)	(0.005)	(0.005)
Bidder fraction of independent directors	0.0772	0.0636	0.0897
	(0.090)	(0.097)	(0.091)
Bidder CEO being COB	0.0154	0.0174	0.0119

Table 5 (*continued*)

Panel B: explaining the bid premium: additional controls			
	# bid initiations		
	(1)	(2)	(3)
	(0.032)	(0.034)	(0.032)
Bidder sales growth	0.0381	0.0452	0.0542
	(0.040)	(0.040)	(0.039)
Bidder Tobin's Q	0.0064	0.0101	0.0094
	(0.008)	(0.009)	(0.008)
Bidder ROA	0.1575	0.1631	0.1573
	(0.098)	(0.147)	(0.097)
Bidder book leverage	−0.0992	−0.0341	−0.1088
	(0.116)	(0.119)	(0.113)
Target board size	−0.0043	−0.0064	−0.0050
	(0.006)	(0.006)	(0.006)
Target fraction of independent directors	0.0787	0.0571	0.0747
	(0.098)	(0.110)	(0.102)
Target CEO being COB	0.0201	0.0079	0.0125
	(0.034)	(0.035)	(0.035)
Target sales growth	−0.0836	−0.0088	−0.0819
	(0.054)	(0.069)	(0.051)
Target Tobin's Q	0.0005	−0.0100	0.0066
	(0.015)	(0.022)	(0.015)
Target ROA	−0.2478	−0.2892	−0.2714
	(0.200)	(0.254)	(0.193)
Target book leverage	0.0756	−0.0209	0.0607
	(0.112)	(0.122)	(0.112)
Bidder logarithm of firm age	−0.0443		
	(0.029)		
Target logarithm of firm age	−0.0327		
	(0.026)		
Bidder E-index		−0.0115	
		(0.012)	
Target E-index		−0.0033	
		(0.014)	
Bidder blockholder ownership			0.3922
			(0.275)
Target blockholder ownership			0.1640
			(0.319)
Constant	0.6043***	0.5760***	0.4042***
	(0.144)	(0.144)	(0.145)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Observations	458	399	458
Adjusted R-squared	0.174	0.141	0.169

level. The Hausman test statistic at −97.17 rejects the null hypothesis that the fraction of female directors is unrelated to the error term of the bid initiation regression.

In summary, we find that the fraction of female directors is associated with fewer M&A deal initiations, consistent with our first hypothesis (H1), and our main findings remain largely unchanged to firm fixed effects, the propensity-score matching approach, and the instrumental variable estimation.

4. Gender diversity and the bid premium

We next examine the association between the fraction of female directors and the size of the bid premium paid in corporate acquisitions.

4.1. Model specification

To explore the possible association between board gender diversity and bid premiums, we run the following cross-sectional regression:

$$\begin{aligned}\text{Bid Premium}_i = {} & \alpha_0 + \beta_1 \text{Bidder fraction of female directors}_i + \beta_2 \text{Target fraction of female directors}_i \\ & + \beta_3 \text{Bidder board size}_i + \beta_4 \text{Bidder fraction of independent directors}_i \\ & + \beta_5 \text{Bidder CEO being COB}_i + \beta_6 \text{Target board size}_i \\ & + \beta_7 \text{Target fraction of independent directors}_i \\ & + \beta_8 \text{Target CEO being COB}_i + \text{Other Controls} + e_i,\end{aligned} \tag{2}$$

where the key explanatory variable of interest is the measure of board gender diversity in the bidder firms. The governance-related variables and controls for deal– and firm-characteristics are motivated by the findings of Byrd and Hickman (1992), Shivdasani (1993), Cotter et al. (1997), Bange and Mazzeo (2004), and Chen et al. (2007). Deal characteristics include the toehold, as well as indicator variables for all cash deals, all stock deals, tender offers, and unfriendly deals. Bidder/target firm characteristics include sales growth, Tobin's Q, ROA, and book leverage. We include year fixed effects and industry fixed effects and employ robust standard errors.

4.2. The merger and acquisition sample

To form our merger and acquisition sample, we start with the acquisition bids made by US public companies for US public targets during the 1997–2009, covered in the Thomson Financial's SDC database, and we impose the same filters on deal types and initial and final ownership as our bid initiation sample. We end up with 5301 deals. Data requirements on deal characteristics such as the bid premium and the transaction value reduce the number of deals in our sample to 2679. These deals are then merged with the RiskMetrics Group's corporate board and director database. These steps further reduce our sample to 470 deals. Firm characteristics and stock returns are retrieved from Compustat and CRSP. Our final merger and acquisition sample consists of 458 acquisition bids.

Table 3 shows that in our sample the average bid premium is 35%. The bid premium is defined as the ratio of the final offer price to the target stock price four weeks prior to the bid, minus one. On average, about 11% of bidder directors are female, with the proportion of female directors ranging from zero at the 5th percentile to 25% at the 95th percentile. On average, about 8% of target directors are female.

On average, the bidder firms own 0.6% of their targets before the bid announcement. In 19% of the acquisitions in our sample, the bidder pays the target with cash only, while 35% of the bidders pay in equity only. Overall, the firm and deal characteristics in our sample are not very different from much larger samples covering earlier periods.

Examination of the correlation matrix (not shown for reason of brevity) shows that the proportion of female directors on a bidder board is negatively and significantly correlated with the bid premium. Overall, the extent of correlation among all pairs of control variables raises little concern for multicollinearity in our regression analysis.

4.3. Female directors and the bid premium

Table 4 Panel A presents the OLS regression results where the dependent variable is the size of the bid premium. In column (1), we find that gender diversity on the bidder board, as measured by the fraction of female directors, is negatively and significantly associated with the size of the bid premium at the one-percent level, consistent with our second hypothesis (H2). In terms of economic significance, each ten percent representation of female directors on the bidder board, corresponding to approximately one female director, reduces the size of the bid premium by 15.4% ($=0.10 \times 0.54/0.35$, where the second term in the numerator is the coefficient on the bidder fraction of female directors, and the denominator is the sample mean bid premium as shown in Table 3).

There is no significant association between female directors on the target board and the size of the bid premium, which we attribute to the following potential reason. There is an information asymmetry between bidder and target board members with respect to the value of the target firm. Both female and male directors on target boards can be expected to have better information than their counterparts on bidder boards regarding the value of their own (target) firms. Hence, the potential for a gap between the views of female and male directors on target boards about their own firm value is relatively small: target firm directors of both genders have a more precise view of target value, limiting the opportunity for a gender-based overconfidence differential.[6]

Panel A column (2) presents the firm fixed effects regression results. The coefficient on the measure of gender diversity of the bidder board remains negative, but becomes statistically insignificant. There are two possible reasons for the lack of significance after including firm fixed effects. First, there are only 95 firms in our sample that initiate more than one M&A deal, thereby limiting the sample size. Second, there is little within-firm variation in the fraction of female directors of these firms over time, as shown above. In fact, the within-firm variation is zero for most of the 95 firms (untabulated).

Table 4 Panel B presents the results of the instrumental variable regression. We use the same instrumental variable as defined earlier for the bidder and the target boards, and thus we end up with two instrumental variables. In column (1) ((2)), we regress the fraction of female directors on the bidder (target) board on the instrumental variables and other controls. For both bidder and target firms the fraction of female directors is positively and significantly associated with its respective instrumental variable. In column (3), we regress the size of the bid premium on the predicted fractions of female directors and other controls. We find that the fraction of female directors on the bidder board is negatively and significantly associated with the size of the bid premium at the ten-percent level. The Hausman test statistic at -3.36 again rejects the null hypothesis that gender diversity of the board is exogenous.[7]

[6] This argument is particularly applicable to the precision interpretation (i.e., the first form) of overconfidence: the better the information, the more precise will be the estimates of future events, and the more similar will be the estimates of male versus female directors.

[7] Note that the small number of mergers and acquisitions (458 deals) with available data for both acquirer and target firms results in poor matching based on the propensity-score, and thus restrains us from applying the propensity-score matching approach to the analysis of the bid premium.

In summary, we find that the fraction of female directors on the bidder board is associated with a lower bid premium, consistent with our second hypothesis (H2). As we shall argue below, the associations between bidder board gender diversity and bid initiation and the bid premium are also consistent with several female behavioral characteristics that have been observed in other contexts.

5. Additional investigation

In this section, we conduct robustness checks on our main findings, and consider other possible interpretations of our findings.

5.1. Robustness checks

First, it can be argued that the significant association between board gender diversity and M&A decisions uncovered in this paper could be driven by other firm characteristics, such as firm maturity and CEO cautiousness. It is worth noting that several of our firm-level explanatory variables such as firm size and board size could be proxies for firm maturity. As a further check, in column (1) in Table 5 Panels A and B we include firm age, another potential proxy for firm maturity, as an additional firm-level control in our model specifications. We find that, as expected, older firms are less likely to initiate acquisitions. On the other hand, firm age is not significantly associated with the size of the bid premium. Importantly, the presence of female directors on corporate boards remains negatively and significantly associated with the number of bid initiations and the size of the bid premium after controlling for firm age. Our acquisitiveness result is consistent with the finding in Levi et al. (2010) that a proxy, male CEO age, that picks up variations in CEOs' levels of the "dominance hormone"—testosterone—is related to the propensity to acquire. Their findings suggest controlling for the presence of acquisitive young male CEOs. In unreported analyses, we include male CEO age as an additional control and show that older male CEOs are negatively associated with the number of acquisition bids.[8] More importantly, the fraction of female directors remains negatively and significantly associated with the number of bid initiations after controlling for male CEO age.

Second, we control for corporate governance as measured by the E-index (Bebchuk et al., 2009), and ownership as measured by the total holdings of blockholders (i.e., shareholders who own more than five percent of shares outstanding). Table 5 presents the results. We show that the E-index is negatively and significantly associated with the number of acquisition bids, suggesting that bad corporate governance makes a firm more acquisitive. The E-index is not significantly associated with the size of the bid premium. Blockholder ownership is not significantly associated with either M&A decision variable. Importantly, our main findings remain unchanged after controlling for corporate governance and ownership.[9]

Third, prior work has shown that boards dominated by independent directors are more likely to make decisions, including M&As, that are in the interest of shareholders (see, for example, Byrd and Hickman (1992), Shivdasani (1993), Cotter et al. (1997), Hermalin and Weisbach (1998), and Paul (2007)). In order to account for this possibility, we need to separate female directors into independent directors (i.e., female directors who neither are corporate executives nor have any kinship or business relationship with the firm), and dependent directors (i.e., female directors who are also corporate executives and/or have family/business relationships with the firm). In unreported analyses, we show that the fractions of independent and dependent female directors are both negatively and significantly associated with the number of bid initiations. The fraction of independent female directors on the bidder board is also negatively and significantly associated with the size of the bid premium. However, there is no significant association between the fraction of dependent female directors and the size of the bid premium.[10]

Fourth, it can be argued that the significant associations between board gender diversity and M&As could be driven by directors' personal economic interests associated with an acquisition, especially given that female directors are paid with fewer equity incentives than male directors (Kulich et al., 2011). To separate the gender effect from directors' financial interests, we control for female director equity ownership.[11] In unreported analyses, we show that female director ownership is not significantly associated with either M&A decision variable. Importantly, after controlling for female director ownership, there remain negative and significant associations between board gender diversity and acquisitiveness and between board gender diversity and the size of the bid premium.

[8] All unreported analyses are available upon request from the authors.

[9] In unreported analyses, we further employ other measures of corporate governance measures including the G-index (Gompers et al., 2003), institutional ownership, and ownership of corporate insiders. Again, our main findings remain unchanged.

[10] In unreported analyses, we also examine the role of women in powerful positions, including being CEO, the Chairwoman of the Board, President, CFO, COO, or as members of the nomination, compensation, audit, or governance committee. A priori, it is worth noting that women being CEOs is relatively rare (Haslam et al. (2010) based on the UK evidence and Levi et al. (2010) based on the US evidence). We find that female CEOs and COOs are negatively associated with the number of bid initiations, while the presence of female directors on the nomination committee is positively associated with the number of bid initiations. Further, women in more powerful positions are not significantly associated with the size of the bid premium. Importantly, our main findings remain after controlling for women in more powerful positions, indicating that both ordinary female directors and those in more powerful positions play important roles in corporate acquisitions.

[11] It is worth noting that female director ownership does not include stock options and thus is a noisy measure of total equity incentives of female directors. Data on directors' holdings of stock options became available only since 2006, although data on executive directors' holdings of stock options became available in the ExecuComp database since 1992.

Finally, if the negative association between the presence of female directors and corporate acquisitiveness is driven by the lower overconfidence of female directors, one would expect to observe similar negative associations between the presence of female directors and other forms of risky corporate investment, such as capital expenditures and R&D expenses. Consistent with our conjecture, in unreported analyses, we show that the fraction of female directors is negatively and significantly associated with both capital expenditures and R&D expenses.

In summary, our findings on the significant associations between board gender diversity and bid initiations and the bid premium are robust to a number of robustness checks.

5.2. Alternative interpretations

Thus far, we have shown that the presence of female directors is associated with fewer bid initiations and lower bid premiums. We have indicated that these associations are consistent with women being less overconfident than men, but that possible endogeneity limits us to speaking only of associations. In this subsection, we discuss and examine whether the observed associations are also consistent with other behavioral characteristics of women investigated in other contexts.

First, our findings could also be driven by the observation that female directors are more effective monitors (Adams and Ferreira, 2009). If female directors were better monitors in the context of M&As we would expect that their presence would be negatively associated with the completion of value-destroying deals. To explore this explanation, we examine to what extent the likelihood of deal completion is associated with the presence of female directors on a bidder board when the bidder announcement period return is negative. In unreported analyses, we find that the coefficient on the interaction term between the fraction of female directors on the bidder board and the bidder announcement period return is negative and significant. This finding is the opposite of what would occur if female directors on the bidder board were effective monitors. We conclude that our findings do not appear to primarily result from female directors being better monitors in M&A settings.

Second, the associations we have found may be driven by the observation that it takes a longer time for a board with female directors to deliberate on an acquisition deal, resulting in fewer deals and better deal quality (a lower bid premium). It has been shown that more diverse boards take a longer time to make decisions (e.g., Erhardt et al., 2003; Milliken and Martins, 1996). In unreported analyses, we regress the number of days from bid announcement to deal completion or withdrawal (in logarithm) on the fraction of female directors and other controls. We find that, indeed, the presence of female directors on the bidder board is positively and significantly associated with the length of time taken to reach a resolution with respect to a bid. We thus cannot reject this possible interpretation of our findings.

Finally, it is also possible that corporate cultures or CEO styles, which are unobservable to us and thus omitted from the regressions, may be the underlying factors behind our main results (Fiordelisi and Ricci, 2013; Graham et al., 2013; Tate and Yang, 2012). This concern over unobserved heterogeneity in cultures and styles is partially alleviated by the estimation results with firm fixed effects, although it is difficult if not impossible to totally rule out this possibility.

6. Conclusions

Consistent with evidence in other financial contexts such as investment, trading, and corporate performance, we have found another association between gender diversity on corporate boards and the functioning of boards in the economically important arena of M&As. Board decisions involving M&As are particularly important not only because of the number of dollars involved, but also because, unlike day-to-day operations, M&As invariably involve intensive deliberation at the board level. Using acquisition bids initiated by S&P 1500 firms during the period 1997–2009, we show that the presence of female directors on a corporate board is negatively associated with their firms' acquisitiveness: women appear to be less motivated by empire building. Furthermore, using data from over 450 acquisition bids for which we have the necessary information on the bidder and target firms, we show that the representation of female directors on a bidder board is negatively and significantly associated with the size of the bid premium: women appear to be less likely to destroy shareholder value. We conclude that the findings of these specific favorable effects of having female directors on corporate boards are consistent with women being less overconfident than men.

With increasing discussion of legislative requirements for more equal female representation on corporate boards around the world (Ahern and Dittmar, 2012; Bøhren and Staubo, 2014–in this issue; Matsa and Miller, 2013), our evidence from studying mergers and acquisitions becomes of considerable economic, political, and social importance.

The effects described in this paper work through the channel of mergers and acquisitions. Many important questions remain. Are there any director gender effects in other corporate decisions? What is the underlying condition behind less overconfidence among women? Is it greater caution? Are women board members different in this important regard than women in general? Could there be other socio-economic groups that might favorably affect the quality of decisions made inside corporate boardrooms? Could it be the diversity of board membership rather than any specific category of membership that might improve board decisions? We hope that the associations uncovered in this paper between female directors and the propensity to acquire and the size of the bid premium will encourage more future research into director gender and board diversity on corporate policies.

Appendix A. Definition of variables

Variable	Definition
# bid initiations	The number of acquisition bids initiated by a firm within a fiscal year. The bid shall take the form of a merger (SDC deal form M), an acquisition of majority interest (AM), or an acquisition of assets (AA). Also, we include only control bids where the bidder's toehold before the deal announcement is less than 50%, and the sum of the toehold and the percentage ownership sought in the deal is greater than 50%.
Fraction of female directors	The number of female directors on a corporate board divided by the board size.
Fraction of male directors linked to female directors	The number of male directors on a corporate board who also sit on boards of other firms that have at least one female director, divided by the board size.
Fraction of independent directors	The number of directors who are not corporate executives—hence the term "independent directors"—divided by the board size.
CEO being COB	An indicator variable taking the value of one if the CEO is also the Chairman of the Board (COB), and zero otherwise.
CEO age	Age of the CEO.
CEO age under 45	An indicator variable taking the value of one if the CEO is not older than 45 years, and zero otherwise.
Board size	The number of directors serving on a corporate board.
Sales growth	The ratio of sales (data item *sale* in Compustat) in the current fiscal year to sales in the last year minus one.
Tobin's Q	The market value of total assets divided by the book value of total assets. The market value of assets is calculated as the book value of total assets (data item *at* in Compustat) minus the book value of common equity (*ceq*) plus the number of common shares outstanding (*csho*) times the stock price (*prcc_f*).
ROA	Income before extraordinary items (data item *ib* in Compustat) divided by the book value of total assets (*at*) at the beginning of the fiscal year.
Book leverage	The sum of debt in current liabilities (data item *dlc* in Compustat) plus long-term liabilities (*dltt*) divided by the book value of total assets (*at*).
Cash holdings	Cash and short-term investments (data item *che* in Compustat) divided by the book value of total assets (*at*).
Market capitalization	The number of common shares outstanding (data item *csho* in Compustat) times the stock price (*prcc_f*).
Bid premium	The ratio of the final offer price to the target stock price four weeks prior to the original announcement date minus one.
Toehold	The proportion of the target firm's shares owned by the bidder before the bid announcement.
All cash	An indicator variable taking the value of one if only cash is used to pay for the acquisition, and zero otherwise.
All stock	An indicator variable taking the value of one if only equity is used to pay for the acquisition, and zero otherwise.
Tender offer	An indicator variable taking the value of one if SDC regards the bid as a tender offer, and zero otherwise.
Unfriendly	An indicator variable taking the value of one if SDC regards the deal as unfriendly, and zero otherwise.
Relative size	The transaction value divided by the market value of total assets of the bidder at the fiscal year end prior to the bid announcement. The market value of assets is calculated as the book value of total assets (data item *at* in Compustat) minus the book value of common equity (*ceq*) plus the number of common shares outstanding (*csho*) times the stock price (*prcc_f*).
Firm age	The number of years since a firm first appears in the CRSP or COMPUSTAT database, as in Pástor and Veronesi (2003) and Frank and Goyal (2009).
E-index	An index based on six antitakeover provisions in the RiskMetrics database: staggered board, poison pills, the supermajority requirement for mergers, limits to the shareholder bylaw amendments, limits to the charter amendments, and golden parachutes. The index increases by one for each antitakeover provision in place.
Blockholder ownership	The aggregate ownership of blockholders who own more than five percent of shares outstanding.

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