

DOES FEMALE REPRESENTATION IN TOP MANAGEMENT IMPROVE FIRM PERFORMANCE? A PANEL DATA INVESTIGATION

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We argue that female representation in top management brings informational and social diversity benefits to the top management team, enriches the behaviors exhibited by managers throughout the firm, and motivates women in middle management. The result should be improved managerial task performance and thus better firm performance. We test our theory using 15 years of panel data on the top management teams of the S&P 1,500 firms. We find that female representation in top management improves firm performance but only to the extent that a firm's strategy is focused on innovation, in which context the informational and social benefits of gender diversity and the behaviors associated with women in management are likely to be especially important for managerial task performance. Copyright © 2012 John Wiley & Sons, Ltd.

INTRODUCTION

For the past few decades, women have made considerable inroads into domains traditionally dominated by men. However, even though women now account for over a third of U.S. managers overall (Bureau of Labor Statistics, 2007), women remain significantly underrepresented at the top of the corporate hierarchy, both in the boardroom (Hillman, Shropshire, and Cannella, 2007) and in top management (Daily, Certo, and Dalton, 1999; Helfat, Harris, and Wolfson, 2006). For instance, in 2006, among the corporations included in the Standard & Poor's (S&P) 1,500 index, which is designed to reflect the overall U.S. equity market,¹ only

30 percent had even a single woman among their top managers, and this figure has stagnated in recent years. See Figure 1.

Beyond the social and ethical implications, the dearth of women at the top of the corporate hierarchy suggests that female representation in top management may have important implications for a firm's competitiveness, not merely as a reflection of a more gender-neutral and, thus, more meritocratic recruitment and promotion process, but more specifically because of the potential benefits of gender diversity itself. With this in mind, this paper asks the following questions: does female representation in top management have a positive effect on firm performance? If so, is the effect general or confined to particular contexts?

In addressing these questions, the paper makes two distinct but related contributions. Our first

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¹ The S&P 1,500 combines the S&P 500 (large capitalization stocks), the S&P MidCap 400, and the S&P SmallCap 600

to cover approximately 90 percent of U.S. market capitalization. It is designed for investors seeking to replicate the performance of the U.S. equity market or benchmark against a representative universe of tradable stocks (Standard & Poor's, 2010).

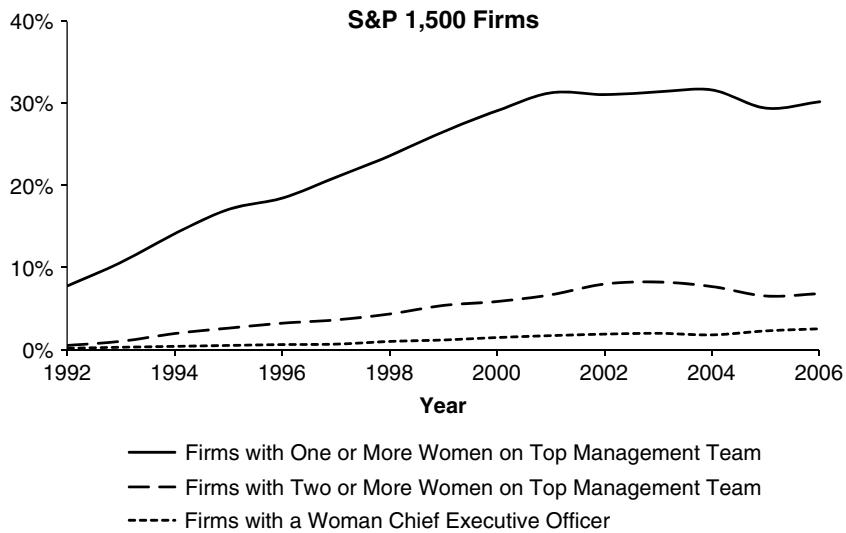


Figure 1. Female representation in top management across time

contribution is to draw on a range of management literatures to craft a theoretical model to explain how female representation in top management brings informational and social diversity benefits to the top management team, enriches the behaviors exhibited by managers throughout the firm, and motivates women in middle management. In consequence, we argue that female representation in top management improves managerial task performance throughout the firm and should, accordingly, lead to better firm performance, even for a firm that has hypothetically eliminated barriers to managerial advancement by women.

Given the importance of identifying moderating contextual factors for both research and practice vis-à-vis organization theory (Lawrence and Lorsch, 1967), upper echelons (Carpenter, Geletkanycz, and Sanders, 2004), and gender in organizations (Butterfield and Grinnell, 1999), an important aspect of our model is to theorize about how strategically relevant organizational contexts moderate the impact of female representation in top management. In that connection, our theoretical model predicts that the positive impact of female representation in top management on firm performance is increasing in a firm's innovation intensity, in which context the improvements in group decision making associated with gender diversity and the managerial attributes of women managers themselves are likely to be especially important. We find, in fact, that innovation intensity does not merely positively moderate the effect

of female representation in top management on firm performance but also that female representation in top management benefits firm performance *only to the extent* that a firm's strategy is focused on innovation.

Our second contribution has both theoretical and empirical dimensions. Terjesen, Sealy, and Singh (2009) point out in a recent comprehensive survey that existing empirical work on the relationship between female representation at the top of the corporate hierarchy and firm performance (the vast majority of which studies corporate boards) has produced decidedly mixed results and, more importantly, does not address the related issues of causality and endogeneity. Contrast, for instance, Lee and James's (2007) well-known finding that hiring a woman chief executive officer (CEO) is associated with a negative stock price reaction, with Carter, Simpkins, and Simpson's (2003) result that gender diversity on boards is associated with better firm performance.

Likewise, a small number of pioneering studies draw on the resource-based view (Shrader, Blackburn, and Iles, 1997), cultural diversity (Richard *et al.*, 2004), and social identity and power sharing (Krishnan and Park, 2005) literatures to theorize about and empirically study the relationship between female representation at various levels of management and firm performance; yet, each of these studies finds no or inconsistent evidence for such a relationship. In addition, constrained by data limitations, these studies do not control for

many observable factors that might influence firm performance (e.g., leverage or firm age), and, more importantly, fail to account for (a) the unobservable heterogeneity associated with particular firms or time periods that might simultaneously affect the level of female representation in top management and firm performance and (b) the related possibility of reverse causality.

In fact, as discussed further below, there exists a range of reasons for expecting that *a priori* better firms are more likely to promote women to their top management teams. As with other aspects of the management of human assets, then, a full picture of the causal linkages between female representation in top management and firm performance 'can best be assessed by evaluating firms' longitudinal financial performance' (Chadwick and Dabu, 2009: 269). We are able to evaluate these causal linkages, because the richness of the panel data we compiled from a variety of public and private sources on the S&P 1,500 U.S. corporations over a 15-year period allows us to control for a wide array of firm and time specific observable and unobservable factors that may affect firm performance, as well as address the possibility of reverse causality. We are consequently able to

provide a significantly more robust analysis of the potential benefits of female representation in top management and the contingencies that moderate these potential benefits than prior work in this area.

THEORETICAL FRAMEWORK

Figure 2 outlines our theoretical model for how female representation in top management may improve the performance of a firm, even a firm that has a hypothetically gender-neutral recruitment and promotion process. We elaborate on our theoretical model below.

Top management team task performance

A firm's behavior and performance are to a large extent a function of its top management team, which makes most of the firm's important strategic and organizational decisions (Hambrick and Mason, 1984; Carpenter *et al.*, 2004). Anything that improves the task performance of the top management team should, accordingly, improve firm performance.

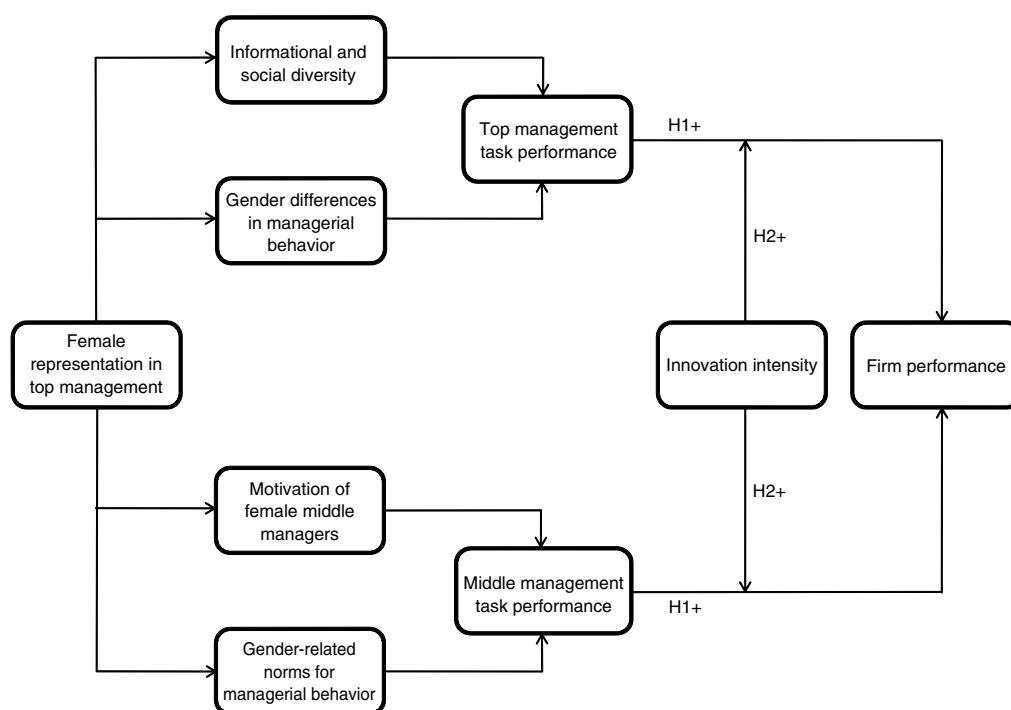


Figure 2. Theoretical model

As shown in Figure 1, top management teams are overwhelmingly composed of men. Accordingly, when a woman joins a firm's top management team, the team becomes more diverse, both in terms of social categorization and information (Van Knippenberg, De Dreu, and Homan, 2004). There are a number of distinct but related reasons why this diversity should improve the information processing and decision making of the team. Clearly, women add to the diversity of life experiences among a top management team's members. Women may, thus, have additional insight into important strategic questions, especially those that relate to female consumers, employees, and trading partners (Daily *et al.*, 1999). In general, more heterogeneous groups have different points of view and knowledge, consider a more comprehensive set of solutions, and debate one another's viewpoints more vigorously, leading to higher quality decisions (Hoffman and Maier, 1961; Wiersema and Bantel, 1992), especially where, as with top management team decision making, the group task has a high information processing component (Van Knippenberg *et al.*, 2004).

Moreover, gender is salient and readily accessible for social categorization (Tsui, Egan, and O'Reilly, 1991; Westphal and Milton, 2000). Such surface-level diversity can trigger expectations that informational differences may be present and legitimize the expression of divergent perspectives among the male majority even if the surface-level diversity is not, in fact, associated with greater information diversity (Phillips, Liljenquist, and Neale, 2009; Phillips and Loyd, 2006). It follows that even the presence of a woman with *congruent* information may stimulate a broader and richer discussion of alternatives and, thus, improve decision making within the top management team.

While diversity may become excessive and cause problems with communication (Wiersema and Bantel, 1992), this concern is unlikely to be empirically relevant for most top management teams, because the number of teams with more than a small minority of women is vanishingly small. Diversity may also negatively impact social cohesion and, thus, employee satisfaction (Tsui *et al.*, 1991). However, affective discomfort does not necessarily imply inferior performance; indeed, research suggests that the affective discomfort associated with diversity is intimately related to the superior decision making to which diversity can give rise (e.g., Phillips *et al.*, 2009). Intuitively,

some level of conflict, dissent, and cognitive cost may often accompany the full elaboration of alternative perspectives that leads to better decision making in diverse groups (Van Knippenberg *et al.*, 2004). Researchers have argued that because of the nonroutine nature of the problems faced by corporate boards, the benefits of gender diversity outweigh the costs (Hillman *et al.*, 2007). These arguments should, if anything, be more applicable to top management teams whose remit is, by definition, more specifically tied to managerial problem solving than corporate boards, which primarily act as monitors and sources of information (Hillman and Dalziel, 2003).

Finally, a large body of field and laboratory work suggests that there may be gender-based differences in managerial behavioral tendencies. Based on surveys and interviews with female leaders, Rosener (1995) finds that women exhibit an interactive leadership style that emphasizes inclusion. Specifically, women are said to encourage participation by soliciting input from others, share power and information by keeping open communication channels with their subordinates, and bolster their subordinates' sense of self-worth. Using similar methods, other authors find women to be less hierarchical and more cooperative and collaborative than men (Book, 2000; Helgesen, 1990). Likewise, meta-analytic investigations reveal that in organizational settings, women tend to manage in a more democratic and participatory way (Eagly and Johnson, 1990). These behaviors, which we collectively call the 'feminine management style,' are conveyed colloquially by Michael Landel, CEO of Sodexo: 'Women like power, but they like to share it. They like to be more collaborative' (Womenomics, 2009). Such managerial behaviors promote the sharing of task-relevant information (Daily and Dalton, 2003), a key process underlying the positive effects of diversity (Van Knippenberg *et al.*, 2004).

We accordingly expect gender diversity, especially in the form of adding a woman to an otherwise all-male top management team, to improve the team's task performance. Better task performance by the top management team, in turn, leads directly to better firm performance.

Middle management task performance

We also expect female representation in top management to have positive reverberations throughout

a firm's management hierarchy for a number of reasons. Career progression through a firm's managerial ranks may be likened to a succession of competitions, each of which has implications for a manager's subsequent upward mobility (Rosenbaum, 1979). Appropriate mentoring relationships and other social contacts are important in this process. Social relationships are heavily influenced and constrained by similarity on social attributes, which notably include gender. The paucity of women in the upper echelons of management thus creates a significant barrier to managerial advancement by women (Ibarra, 1993; Noe, 1988), reducing their opportunity to acquire the experience that is important for their own advancement, for example, by working in management trainee programs (Sheridan *et al.*, 1990) or in corporate office positions, which may be especially valuable for women (Hurley and Sonnenfeld, 1998). Conversely, where women do occupy senior managerial positions, they have been found to focus more than men on the development and mentoring of their subordinates, encouraging them to reach their full potential and rewarding them for good performance (Eagly, Johannesen-Schmidt, and van Engen, 2003).

Thus, a woman has good reason to believe that the presence of women in top management positions is a critical factor for her likely success at the firm and adjust her commitment and motivation accordingly. Indeed, researchers have argued that the presence of a woman on the corporate board indicates that, whatever barriers to advancement by women may exist in society, the culture of the firm is friendly to women and committed to the advancement of women at all levels (Bilimoria, 2000, 2006; Daily and Dalton, 2003), enhancing the motivation and organizational commitment of women in lower-level managerial positions. Given that the members of the top management team are more likely than board members to have been recruited from within the firm, we would expect the positive impact of female representation in top management on the motivation of lower-level women managers to be stronger than the effect of female board representation. It follows that female representation in top management should engender greater motivation and organizational commitment in lower-level women managers, leading them to improve their individual performance and contributions to the managerial groups to which they belong.

In addition, women managers may face a problem of incongruity between expectations about the actual and ideal behavior of women and men on the one hand, and the attributes typically associated with successful leaders on the other (Ely and Meyer, 2000). Specifically, based on the descriptive aspect of the female gender role, women are deemed to possess inferior leadership abilities; when women fail to perform well on masculine aspects of competence, their failures are interpreted as confirming these stereotypes. Meanwhile, based on the injunctive aspect of the female gender role, women are evaluated less favorably or even denigrated when their behavior fulfills the prescriptions of the leadership role, because this violates the female gender role.

However, empirical evidence suggests that women experience this role conflict less and have a more positive view of their own gender in firms with greater gender integration at senior levels of the management hierarchy (Ely, 1994, 1995). In addition, women (and possibly men) in gender-integrated firms are more apt to enact masculine or feminine behaviors according to the demands of the task, rather than in conformity with historical gender norms (Ely, 1995).² It follows that women (and possibly men) in lower-level managerial positions may regard the presence of a woman on the firm's top management team as a signal that the managerial behaviors associated with the feminine management style described above are valued by the organization, effectively legitimizing the adoption of these behaviors by women (and possibly men) when doing so would improve individual and group task performance.

We accordingly expect that female representation in top management will not only improve the task performance of the top management team itself but also increase the motivation and commitment of women at lower managerial levels as well as encourage the adoption of behaviors associated with the feminine management style, as and when appropriate. Each of these effects should, in turn, improve individual and group task performance

² One lawyer interviewed by Ely (1995: 613) put the matter thus: 'Women bring something to an all male institution when you integrate it. . . . I think that men, when they run in packs, tend to act like small boys. I think there's a lot of the pecking-order-establishing and one-ups-manship and bravado. And I think women reduce the need for that somewhat. It still exists, but I think one thing women do is that they allow the existing men who are above that to feel comfortable excusing themselves from it because the women do, by and large.'

throughout the firm and thereby improve firm performance itself. We accordingly propose:

Hypothesis 1: Female representation in top management has a positive effect on firm performance.

Strategic context and the benefits of gender diversity

We expect the benefits of diversity to be context specific (Klein and Harrison, 2007). Gender diversity, by leading to more thorough information processing and consideration of divergent views, should be particularly valuable for tasks requiring creative solutions (Van Knippenberg *et al.*, 2004), such as the process of innovation, which relies on the insightful and unique recombination and reapplication of existing resources (Penrose, 1959; Schumpeter, 1934). Diversity has in general been associated with high levels of creativity and innovation (Wiersema and Bantel, 1992), and Hoffman and Maier (1961) find that gender diversity in particular facilitates creativity. It follows that female representation in top management should be especially beneficial for firms for which innovation is important to strategy and thus is more relevant to the activities of managers throughout the firm (Ginsberg, 1994).

Differences in managerial behavior may also provide context specific benefits. In general, innovation leaves managers more latitude to make decisions, thereby amplifying the importance of managerial effectiveness for firm performance (Castanias and Helfat, 2001). Motivation is also a key contributor to creativity (Oldham and Cummings, 1996). The positive implications of female representation in top management for the motivation and organizational commitment of women managers at lower levels in the hierarchy should accordingly be particularly beneficial where these women managers are more heavily engaged in innovation-related tasks.

Supervisory behavior is another important influence on employee motivation. For example, 'informational verbal rewards' have been found to increase intrinsic motivation while 'controlling verbal rewards' do not (Pittman *et al.*, 1980; Ryan, Mims, and Koestner, 1983). 'Supportive' managerial behaviors have been found to bolster feelings of self-determination and personal initiative and thereby increase intrinsic motivation, whereas

controlling supervisory behaviors undermine intrinsic motivation (Oldham and Cummings, 1996). Research also finds that intrinsic motivation is bolstered by autonomy support, which leads to better conceptual learning, itself a contributor to creativity (Deci and Ryan, 1987). Lastly, empowering and participatory leadership styles have been linked to intrinsic motivation and creativity (Zhang and Bartol, 2010), as well as to more sharing of information in group discussions (Larson, Foster-Fishman, and Franz, 1998), which should lead to the generation of more ideas. It follows that innovation success is a product of 'bargaining and negotiation' to 'accumulate information' and 'coalition building,' not 'domination of others' (Kanter, 1983: 157, 1988).³

Intriguingly, these more cooperative, nurturing, and collaborative managerial behaviors overlap considerably with the feminine management style as described above. To the extent that female representation in top management promotes such managerial behaviors, either as directly manifested by the women on the top management team or as a response by women (and possibly men) at lower levels of the firm's hierarchy to a less male-dominated work environment, we would expect female representation in top management to be particularly beneficial for firms for which innovation is important to strategy. These various arguments all imply the following hypothesis:

Hypothesis 2: The effect of female representation in top management on firm performance is positively moderated by innovation intensity.

METHODS

Data and variable definitions

Our source for the size and gender composition of top management teams is S&P's ExecuComp database, which contains information on senior managers from proxy statements and other public

³ Experimental evidence supports this general proposition. In an R&D context, for instance, both Andrews and Farris (1967) and Amabile (1988) find that 'freedom' for employees is positively associated with innovation. Oldham and Cummings (1996) obtain similar results among technical teams in manufacturing facilities. Scott and Bruce (1994: 584) show that the degree to which interactions between a supervisor and subordinate are characterized by 'trust, mutual liking, and respect' is positively related to the subordinate's innovative behavior.

filings of the S&P 1,500 firms, a widely used index of public companies designed to reflect the broad U.S. equity market (Standard & Poor's, 2010); our sample covers the years 1992, the first year of the ExecuComp data, through 2006. Although the rules have changed modestly since 1992, in general, U.S. public companies have been and continue to be required to report information on the CEO and four other most highly paid managers. We accordingly have information on at least five managers for the substantial majority of firm years in the data, and some firms report information for a small number of additional managers. We take the managers reported in ExecuComp to be a firm's top management team. At 5.9, the mean size of a top management team in our data is in line with studies in the upper echelons literature, which typically report the 'inner circle' of top management teams to number between three and seven people (Carpenter and Sanders, 2002). Our definition of the top management team is broader than that of the 'dominant coalition' of the early upper echelons literature, which typically included only managers who also serve on the board of directors (Carpenter *et al.*, 2004).

We use S&P's CompuStat database as a source of financial information about the firms in our sample. CompuStat collects financial information from firms' public filings. We use the Center for Research in Securities Prices (CRSP) as a source of firms' initial public trading date. CRSP provides stock trading information for firms whose shares trade on the NYSE, AMEX, and NASDAQ exchanges.

Female representation

While, in principle, women could account for any percentage of the top management team of a given firm, (a) the fraction of firms with even a single woman on the top management team never reaches a third in any year and is usually substantially lower, and (b) the number of firms with more than one woman on the top management team never exceeds 8.5 percent. (See Figure 1.) We accordingly operationalize female representation in top management using a dummy variable, female representation, which takes the value 1 (0) if any (none) of the managers reported in ExecuComp for a given firm in a given year is female. (We consider alternative measures of female representation in top management below.)

Firm performance

While we consider accounting measures of performance in an extension to our base case analysis, our primary measure of firm performance is Tobin's q, which is defined as the ratio of the market value of a firm's assets to their replacement value (Tobin, 1969). The idea is that better firms create more economic value from a given quantity of assets. Importantly, Tobin's q is a forward-looking measure that captures the value of a firm as a whole rather than as the sum of its parts and implicitly includes the expected value of a firm's future cash flows, which are capitalized in the market value of a firm's assets (i.e., the combined market value of a firm's debt and equity).⁴ By contrast, accounting rates of return are backward-looking and, because of biases in their calculation, may diverge significantly from true economic rates of return (Benston, 1985). Moreover, accounting numbers may be distorted by differences in risk, tax laws, and latitude in interpreting accounting regulations (Wernerfelt and Montgomery, 1988), as well as by earnings management (Healy and Wahlen, 1999). Tobin's q implicitly uses the correct risk-adjusted discount rate, imputes equilibrium returns, and minimizes the distortion from tax laws and accounting conventions (Wernerfelt and Montgomery, 1988). We also note that investors, who ultimately determine the market value of a firm in the calculation of Tobin's q, are increasingly focused on diversity as a driver of value; in fact, the Securities and Exchange Commission promulgated new rules requiring public firms to report board diversity from early 2010, largely in response to overwhelming demand from individual and institutional investors (Aguilar, 2009).⁵

We follow Bertrand and Schoar (2003) in calculating Tobin's q: market value is the book value of a firm's assets plus the market value of the firm's common equity minus the book value of common equity and deferred taxes; replacement value is the book value of the firm's assets. We use a log

⁴ For these reasons, Tobin's q has long been favored as a measure of overall firm performance in management, economics, and finance (e.g., Lang and Stulz, 1994; Berger and Ofek, 1995; King and Lennox, 2001; Durnev, Morck, and Yeung, 2004.)

⁵ Large investment funds that have campaigned publicly for greater gender diversity at the top of the corporate hierarchy include CalPERS, CalSTRS, and Pax World Funds, which sponsors the Global Women's Equality Fund, a mutual fund that focuses on investing in companies that promote gender equality and women's empowerment.

transformation of Tobin's q in our analysis to reduce skewness.

Innovation intensity and other controls

We measure innovation intensity as the ratio of research and development (R&D) expense to assets from the prior year and use it as a control in our analysis. We also use the interaction between female representation and innovation intensity to test Hypothesis 2. We use a broad set of additional control variables, many of which are commonly found in research on top management teams: (i) *size*, as measured by book assets from the prior year; (ii) *firm age* (in years), with firm birth determined by the earlier of the firm's first year in CompuStat or CRSP; (iii) *leverage*, or the ratio of debt to assets; (iv) *CapEx intensity*, the ratio of capital expenditures to assets from the prior year; (v) *marketing intensity*, the ratio of advertising expense to assets from the prior year; (vi) *age of capital stock*, which we measure indirectly as the ratio of depreciation expense to net property, plant, and equipment, since the book value of assets with a longer remaining useful life should be higher in relation to current depreciation expense; and (vii) the *number of managers* on the top management team reported in ExecuComp, as larger teams may be more likely to have a woman manager simply by dint of their size. (Size, innovation intensity, CapEx intensity, marketing intensity, and age of capital stock are log transformed to reduce skewness.) If R&D expense or advertising expense is not material, a firm is not required to disclose it as a separate line item. Accordingly, if one of these items is not separately disclosed, we impute the value of 0 to it.

Statistical analysis

As noted, we test our hypotheses regarding the effect of female representation in top management on firm performance, while controlling for the many idiosyncratic and unobservable factors that may simultaneously affect a firm's performance and make the firm's work environment more or less congenial to women managers. The longitudinal nature of our data allows us to do this by including firm fixed effects in all of our regressions. By including a separate dummy variable for each firm, our statistical tests implicitly compare each firm with itself, that is, when the

firm has female representation in top management with when it does not, as well as for the industry in which a firm competes, since industries are composed of firms.

Figure 1 shows that female representation in top management increased steadily from 1992 until leveling off early in the 2000s. Social and economic trends over time may simultaneously affect firm performance and the propensity of firms to hire and promote senior women managers, for example, due to the diffusion of specific human resources practices that accommodate the personal commitments of women (Bloom, Kretschmer, and Van Reenen, 2009). Again, we use the longitudinal nature of our data to control for these trends by including year fixed effects in all of our regressions.

RESULTS

Table 1 provides descriptive statistics for the variables used in the study, as well as their correlations. The low mean of female representation reflects the large number of firms without women in top management. The majority of firms are less than 30 years old, although a small number are significantly older.

Although most of the correlations are relatively small in magnitude, female representation does have a correlation of 0.32 with the interaction between female representation and innovation intensity. To ensure that this and other potential sources of collinearity are not affecting our results, we calculated variance inflation factors for these two variables and all of the controls described above. Female representation and the interaction between female representation and innovation intensity had variance inflation factors of 1.20 and 1.50, respectively, and none of the control variables had a variance inflation factor over 1.61. As these figures are well below Kutner and Nachtsheim's (2004: 409) suggested cutoff value of 10, we conclude that collinearity is not a significant issue in our analysis.

Base case analysis

Table 2, Column 1 reports the results of a fixed effects regression of Tobin's q on the control variables. All the controls are highly significant except for marketing intensity and number of managers.

Table 1. Descriptive statistics and correlations

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12
1. Female representation	0.236	0.425												
2. Innovation intensity	0.034	0.087	0.00											
3. Size	7.122	1.859	0.02	-0.32										
4. Firm age	24.259	19.275	-0.02	-0.18	0.46									
5. Leverage	0.232	0.240	-0.01	-0.11	0.18	0.13								
6. CapEx intensity	0.071	0.099	-0.02	0.22	-0.22	-0.12	0.00							
7. Marketing intensity	0.013	0.047	0.04	0.12	-0.11	-0.03	-0.04	0.13						
8. Age of capital stock	0.203	0.191	0.04	0.23	-0.17	-0.23	-0.12	-0.15	0.03					
9. Number of managers	5.930	1.435	0.13	-0.02	0.22	0.18	0.05	-0.04	0.00	-0.03				
10. Tobin's q	1.039	0.390	0.05	0.42	-0.34	-0.23	-0.19	0.18	0.15	0.13	-0.08			
11. Return on assets	0.095	0.157	0.00	-0.36	-0.02	0.00	-0.11	0.00	-0.03	-0.17	-0.04	0.22		
12. Return on equity	0.106	0.331	0.00	-0.07	0.06	0.00	-0.04	0.09	0.01	-0.13	-0.04	0.13		
13. Female representation × innovation intensity	0.008	0.045	0.32	0.46	-0.15	-0.09	-0.02	0.07	0.03	0.12	0.04	0.25	-0.15	-0.03

Size and age of capital stock are negatively related to Tobin's q, whereas innovation intensity and CapEx intensity are positively related to Tobin's q. In each case, the result can be explained by the positive association between Tobin's q and growth opportunities (Lang, Ofek, and Stulz, 1996). Leverage has a negative association with Tobin's q, as slow-growth cash rich firms have more capacity to make regular debt payments. Interestingly, firm age is positive and significant. This may be the converse of the 'liability of newness' (Stinchcombe, 1965: 148).

Hypothesis 1 predicts that firms with female representation in top management will enjoy superior performance. Table 2, Column 2 tests this proposition by adding female representation to the regression in Column 1. The coefficient on female representation is positive and statistically significant at the five percent level, even in the presence of over 2,500 firm dummies to account for unobservable firm-level heterogeneity. This result provides indicative support for Hypothesis 1.

Female representation is also economically significant. The coefficient on female representation of 0.0119 means that, *ceteris paribus*, Tobin's q is approximately 1.19 percent higher with female representation in top management than without.⁶ More precisely, the mean value of book assets is \$1.239 billion while the mean of value of Tobin's q is 1.83,⁷ implying a firm value of \$2.263 billion (\$1.239 billion multiplied by 1.83). The coefficient on female representation of 0.0119 implies an increase in Tobin's q to about 1.86⁸ and in firm value to \$2.305 billion (\$1.239 billion multiplied by 1.86). Thus, female representation in top management leads to an *increase of \$42 million* in firm value at roughly the midpoint of the data.

Innovation intensity

Hypothesis 2 predicts that innovation intensity will positively moderate the relationship between female representation in top management and firm

⁶ Since the dependent variable, Tobin's q, is log-transformed, the coefficients on the independent variables can be interpreted as representing approximate percentage changes in the underlying dependent variable.

⁷ The figures are obtained after reversing the log transformation of the mean size of 7.122 and mean Tobin's q of 1.039 in Table 1.

⁸ This figure is obtained after adding the effect of female representation to the mean of Tobin's q, yielding 1.051 (1.039 plus 0.0119), and then reversing the log transformation.

Table 2. Female representation in top management and firm performance

	Tobin's q		
	1	2	3
Innovation intensity	0.4461*** (0.0335)	0.4470*** (0.0335)	0.3803*** (0.0350)
Size	-0.1304*** (0.0034)	-0.1302*** (0.0034)	-0.1300*** (0.0034)
Firm age	0.0097*** (0.0008)	0.0094*** (0.0008)	0.0095*** (0.0008)
Leverage	-0.0266*** (0.0089)	-0.0266*** (0.0089)	-0.0276*** (0.0089)
CapEx intensity	0.1531*** (0.0221)	0.1528*** (0.0221)	0.1571*** (0.0221)
Marketing intensity	0.0058 (0.0552)	0.0068 (0.0552)	0.0125 (0.0551)
Age of capital stock	-0.2578*** (0.0147)	-0.2581*** (0.0147)	-0.2586*** (0.0147)
Number of managers	-0.0002 (0.0014)	-0.0003 (0.0014)	-0.0004 (0.0014)
Female representation		0.0119** (0.0056)	-0.0020 (0.0060)
Female representation × innovation intensity			0.3698*** (0.0566)
Year fixed effects	Y	Y	Y
Firm fixed effects	Y	Y	Y
Number of observations	21,790	21,790	21,790
R ²	0.72	0.72	0.72

*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$. Standard errors are reported under each coefficient in parentheses.

performance. To test this, Column 3 adds the interaction between female representation and innovation intensity to the regression in Column 2. In Column 3, the coefficient on female representation represents the ‘simple’ effect of female representation in top management on firm performance, that is, the effect when a firm’s strategy is not at all related to innovation, because innovation intensity is zero (Echambadi and Hess, 2007; Jaccard and Turrisi, 2003); this coefficient is not statistically different from zero. In contrast, the coefficient on the interaction term is positive and highly statistically significant. Thus, the more a firm’s strategy is focused on innovation, the more female representation in top management improves firm performance.⁹

⁹ If we mean-center innovation intensity, the sign and magnitude of the interaction between female representation and innovation intensity and the precision of the fit between the data and model are both identical. After mean-centering, the coefficient on female representation is larger, because it is a *main* effect, that is, the effect of female representation in top management at the *average* value of innovation intensity. The main effect of female representation can be derived directly from the regression we

This result strongly supports Hypothesis 2 and establishes an important boundary condition for the benefits of female representation in top management: While we find no evidence that female representation in top management may impair firm performance, in order for female representation in top management to have a *positive* impact on firm performance, the firm’s strategy must be focused to some positive degree on innovation.

Again, the effects are economically significant. We demonstrate this by decomposing the simple and interaction effects of female representation and innovation intensity. The implied coefficient on female representation is equal to 0.3698 multiplied by the level of innovation intensity. Thus, if innovation intensity is zero, female representation in top management does not have a statistically significant effect on firm performance.

report using a simple calculation (Echambadi and Hess, 2007). Because we consider the untransformed regression to have a more natural interpretation in this setting, we report regressions without mean-centering.

Table 3. Female representation in top management and firm performance: alternative measures of female representation

	Measure	
	Percent of women on top management team	Dummy variable excluding female CEOs
Female representation	-0.0092 (0.0276)	-0.0004 (0.0060)
Female representation × innovation intensity	1.6224*** (0.2706)	0.3670*** (0.0569)

*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$. Standard errors are reported under each coefficient in parentheses.

However, at the mean level of innovation intensity of 0.034, the implied coefficient on female representation is 0.0126, implying an increase in firm value from female representation in top management of about \$44 million when calculated as above.

ROBUSTNESS AND EXTENSIONS

Alternative measures of female representation in top management

In our base case analysis, we measure female representation in top management using a dummy variable. Given that a small number of firms in our sample have more than one woman on the top management team, we redefine female representation as the percentage of a firm's top management team accounted for by women, and repeat the regression from Table 2, Column 3. The first Column in Table 3 presents an excerpt of the results, which are qualitatively unchanged.¹⁰

By its nature, the CEO position would seem to have unique leadership attributes. Indeed, Lee and James (2007) find that firms' stock prices react negatively to the appointment of a woman CEO but exhibit no reaction to the appointment of women to other senior positions. We accordingly redefine female representation to exclude women CEOs and repeat the regression from Table 2, Column 3, with an excerpt of the results in the

¹⁰ The coefficient on the interaction between female representation and innovation intensity of 1.6224 implies that adding a woman to a five-person top management team would increase Tobin's q by 20 percent of 1.6224, which is 32.4 percent. That implies an increase in firm value of approximately \$39 million when calculated as in the Results section above. Extrapolating this calculation should be done with caution, however, as very few top management teams in the data have a majority of women.

Table 4. Female representation in top management and firm performance: accounting measures of firm performance

	Measure	
	Return on assets	Return on equity
Female representation	-0.0043 (0.0027)	-0.0059 (0.0081)
Female representation × innovation intensity	0.1592*** (0.0234)	0.2585*** (0.0787)

*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$. Standard errors are reported under each coefficient in parentheses.

second Column of Table 3. The results are again qualitatively unchanged.

Alternative measures of firm performance

While we have focused on Tobin's q as a performance measure because it is forward-looking and holistic, there may be some interest in the relationship between female representation in top management and accounting measures of firm performance. We accordingly repeat the analysis in Table 2, Column 3 using return on assets and return on equity as dependent variables and report an excerpt of the results in Table 4.¹¹ In line with the base case analysis, the simple effect of female representation is insignificant, whereas the coefficient on the interaction between female representation and innovation intensity is positive and highly statistically significant. Thus, the performance implications of female representation

¹¹ Return on assets is defined as operating income over assets from the prior period, and return on equity is defined as income before extraordinary items over common equity from the prior period. As with Tobin's q, we apply a log transformation to reduce skewness.

Table 5. Female representation in top management and firm performance: endogeneity and reverse causality

	Tobin's q	
	1: Fixed effects OLS	2: Arellano-Bond
Tobin's q [$t-1$]	0.4040*** (0.0006)	0.3596*** (0.0107)
Innovation intensity	-0.0610* (0.0362)	0.1081 (0.0813)
Size	-0.1029*** (0.0032)	-0.1609*** (0.0077)
Firm age	0.0077*** (0.0007)	0.0583*** (0.0019)
Leverage	-0.0018 (0.0077)	0.0817*** (0.0127)
CapEx intensity	-0.0144 (0.0285)	-0.4457*** (0.0721)
Marketing intensity	-0.1538** (0.0770)	-0.7068*** (0.1738)
Age of capital stock	-0.1423*** (0.0133)	-0.0979*** (0.0183)
Number of managers	-0.0037*** (0.0013)	-0.0026 (0.0028)
Female representation	-0.0017 (0.0053)	0.0181 (0.0144)
Female representation \times innovation intensity	0.2172*** (0.0549)	0.3269*** (0.1089)

*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$. Standard errors are reported under each coefficient in parentheses.

in top management are reflected in firms' accounting data.

Endogeneity and reverse causality

While our theoretical model holds that female representation in top management improves firm performance, there are also rarely articulated but still valid theoretical reasons for believing that, conversely, improved firm performance may lead to female representation in top management. The scarcity of women with experience in senior managerial positions (Hillman, Cannella, and Harris, 2002) may allow those women to self-select into more successful firms (Farrell and Hersch, 2005). More successful firms may be more likely to respond to pressure to conform to the aspirational norm of gender diversity, because they have a greater need for legitimacy (Meyer and Rowan, 1977), or because they have greater latitude and excess resources to do so (Pfeffer and Salancik, 1978). These theoretical arguments suggest that female representation may endogenously depend on recent firm performance and, thus, that the positive association between female representation

and firm performance may be driven by reverse causality. If so, then once we control for prior firm performance, the positive association between female representation and firm performance should disappear.

Accordingly, as a robustness check, we add the lagged value of Tobin's q to the regression in Table 2, Column 3 and report the results in Table 5, Column 1. Even in this demanding specification, we obtain qualitatively similar results. While the lagged value of Tobin's q is positive and significant, as expected, the simple effect of female representation is not significant, and the interaction between female representation and innovation intensity is positive and highly statistically significant.

Adding the lagged value of the dependent variable to a panel data regression can give rise to problems with autocorrelation. Moreover, the other control variables associated with firm policies may also be endogenous. Arellano and Bond (1991) propose a dynamic panel generalized method of moments estimator to account for these issues. We accordingly repeat the analysis in Table 5,

Column 1 in Column 2 using their estimator.¹² We obtain qualitatively the same result: the lagged value of Tobin's q is positive and significant, the simple effect of female representation is not significant, and the interaction between female representation and innovation intensity is positive, highly statistically significant, and larger than in Column 1. Our results are thus robust to controlling for endogeneity and reverse causality.

DISCUSSION AND CONCLUSION

Contributions

In this paper, we develop a theoretical model to explain how and under what circumstances female representation in top management improves firm performance. We test our theory using 15 years of data on a large and comprehensive sample of public U.S. corporations and find that (a) female representation in top management leads to better firm performance but (b) *only to the extent* that a firm is focused on innovation as part of its strategy.

Gender diversity has been identified as representing a 'needed innovation' for top management research (Carpenter *et al.*, 2004: 771), because it is salient and readily accessible for group categorization even without necessarily reflecting cognitive differences (Tsui *et al.*, 1991; Westphal and Milton, 2000). By elaborating on the benefits associated with gender diversity and the contingencies under which these benefits are likely to be amplified, this paper not only contributes to our understanding of gender in management but also extends the literature on top management teams beyond the well-established fact that managerial demographics, broadly construed, matter for firm outcomes.

The paper's results also have important ramifications for policy and practice, in which context the persistent underrepresentation of women in the upper echelons of management has received significant attention. While arguments in favor of equality of opportunity have generally carried the day as an abstract principle, redressing the underrepresentation of women in management has been frustrated by the perception among many male managers that efforts to promote gender diversity

are motivated, *inter alia*, by 'political correctness' or a goal of favoring women at the expense of men (Catalyst, 2009). Indeed, the very word 'diversity' provokes strong emotional reactions in many people (Milliken and Martins, 1996). To overcome such resistance, as well as to capture the attention of senior managers who may be sympathetic to gender equity but may also be extremely busy, making a compelling *business case* for diversity is critical (Catalyst, 2009; Conrad, 2009). However, while scholars have advanced many arguments extolling the benefits of gender diversity in top management, rigorous systematic evidence regarding how and in what circumstances female representation in top management improves firm performance has been lacking.

We address this gap in the literature using a rich panel dataset, which allows us to control for a wide range of observable and unobservable factors that influence firm performance as well as for the possibility of reverse causality. In essence, our econometric specification compares each firm with itself, that is, when the firm has female representation in top management with when it does not. We find that, *ceteris paribus*, a given firm generates on average one percent (or over \$40 million) more economic value with at least one woman on its top management team than without any women on its top management team and also enjoys superior accounting performance. Moreover, while the benefits of female representation in top management are increasing in the innovation intensity of a firm's strategy, even firms without any significant emphasis on innovation do not experience impaired performance as a result of female representation in top management. Thus, our results suggest that even CEOs who believe their firms have gender-neutral recruitment and promotion processes should ensure that their firms maintain at least some level of gender diversity in top management. We believe that these results make a powerful business case for gender diversity and suggest that a CEO who goes the extra mile to help women overcome barriers to their managerial advancement will often be rewarded with improvements in firm performance.

Caveats and directions for future research

This study is not without limitations, many of which may indicate fruitful avenues for future research. While the empirical approach in this

¹² The specification treats variables that could be influenced by firm policy in period t as endogenous and those that are not in the control of the firm or are calculated exclusively with respect to $t-1$ values as exogenous.

study has clear strengths, we nonetheless acknowledge that the small sample field studies employed in other research domains may offer a richer understanding of context than our large sample methods can. In particular, such studies may provide supporting anecdotal evidence regarding the mechanisms that we theorize are behind the benefits of female representation in top management for firm performance. We regard that work and ours as mutually complementary. It is only through a willingness to cross paradigmatic boundaries that we will gain the best appreciation of how to accommodate the needs of women managers as well as deepen our understanding of the contribution they can make to firm performance.

It could be argued that our results may be partly driven by a human capital advantage. Women managers face many barriers to their advancement including, but not limited to, overt discrimination (Oakley, 2000) and social pressure leading to unintentional discrimination by colleagues (Altonji and Blank, 1999). Some firms may have unobservable attributes like cultures (Barney, 1986) or routines (Nelson and Winter, 1982) that reduce these barriers, leading to a sustained human capital advantage (Coff, 1997) from a superior manifestation of female managerial talent and, thus, to a higher quality managerial workforce overall. Women may also need to be 'that much better' to overcome barriers to their advancement, implying that senior women managers are of higher average quality than their male counterparts. Finally, effective management of human assets is a key success factor for innovative high technology firms (Banerjee and Campbell, 2009), and human assets are one of the most coveted resources and a key objective of acquirers in technical industries (Ranft and Lord, 2000, 2002). So, a human capital advantage may be more important in those contexts.

However, these arguments relate primarily to differences among firms. To wit, firms where one is more likely to observe women on the top management team are precisely those where the barriers to women's advancement are lower and, thus, where the presence or absence of women on the top management team would be more likely to reflect random idiosyncratic factors than the quality of the managers who compose the team. Therefore, any positive association between female representation in top management and firm performance that is driven by an advantage in the management of human capital should disappear in the empirical

specification we use herein, which implicitly compares firms with themselves by including a separate fixed effect for each firm, in addition to a fixed effect for each year. By contrast, our theoretical model provides a comprehensive explanation for why a given firm, even one that has a hypothetically gender-neutral recruitment and promotion process, would benefit from female representation in top management.

There may be a similar explanation for why we find that a firm's strategy must be at least somewhat focused on innovation for female representation in top management to benefit firm performance. By including a separate fixed effect for each firm in our data, our empirical testing strategy creates a high hurdle for finding a statistically significant effect of female representation in top management. Firms where one is more likely to observe a woman on the top management team are also those that are more likely to have women at senior levels just below the top management team in years when there is no woman on the top management team. Female representation just below top management may provide these firms some of the benefits that we hypothesize arise from female representation in top management, reducing the power of our statistical tests. If so, then, the performance benefits from female representation in top management would be even larger than our analysis implies and could accrue even to firms for which innovation is not important to strategy.

It is also possible that there are countervailing aspects of gender diversity that reduce the benefits of female representation in top management. The full elaboration of alternative points of view and sources of information to which gender diversity in the top management team gives rise may actually be counterproductive for routine tasks (De Dreu and Weingart, 2003). In general, homogenous groups may perform slightly better on simple tasks, even though heterogeneous groups do better on difficult tasks (Bowers, Pharmer, and Salas, 2000; Hambrick and Mason, 1984). Tsui *et al.* (1991) find, moreover, that diversity in gender and race has deleterious effects on the psychological commitment, absenteeism, and intention to stay of men working in operating units, suggesting that gender diversity may reduce the overall motivation of male managers. Where innovation is not at all important to a firm's strategy and the functions of the top management team are accordingly highly

routinized, these potential negative effects of gender diversity may be sufficient to offset the benefits we hypothesized.

There is, likewise, ample scope for future research to consider other factors that may moderate the impact of female representation in top management on firm performance. For instance, the alternative perspectives of senior women managers may be especially valuable for firms that have a disproportionately large number of female customers. The size, structure, and composition of a firm's workforce may also influence the effect of female representation in top management, although the direction of the influence is not clear. On the one hand, the enhanced motivation of women managers engendered by female representation in top management may be especially beneficial for firms with a large percentage of women managers at lower levels in the hierarchy; on the other hand, firms without a large percentage of women at lower levels may benefit from hiring senior women managers to assist in recruiting women to lower levels. Similarly, while senior managers may have a greater relative effect in firms with smaller workforces, the nature of the senior manager's job and the degree to which women are underrepresented in senior management may also differ with the size of a firm's workforce. The degree to which innovation activities are distributed throughout a firm's organizational structure rather than being compartmentalized into specialized units may also affect the degree to which a firm's focus on innovation moderates the impact of female representation in top management.

Lastly, there is reason to believe that the results of this study may vary in other places and settings. To wit, research suggests that new practices are initially adopted by firms seeking to benefit from the overt purpose of these practices but that later adopters are more interested in gaining legitimacy (Westphal and Zajac, 1994; Zucker, 1983). It is also possible that as a younger generation of managers rises to the top of the corporate world, the effects of female representation on firm performance may change. It would therefore be interesting to examine whether the benefits of female representation in top management will persist if, at some future time, there is greater gender equality in the upper echelons of U.S. corporations. These and other questions suggest the need for more research on gender and management.

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