What changes after women enter top management teams? A gender-based model of strategic renewal

WHAT CHANGES AFTER WOMEN ENTER TOP MANAGEMENT TEAMS? A GENDER-BASED MODEL OF STRATEGIC RENEWAL

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WHAT CHANGES AFTER WOMEN ENTER TOP MANAGEMENT TEAMS? A GENDER-BASED MODEL OF STRATEGIC RENEWAL

The question of what changes when women enter upper echelons teams has long frustrated upper echelons and gender researchers. We build on the dynamic strategic renewal literature, combine it with upper echelons theory (UET) insights and integrate knowledge about female executives' career strategies to theorize *how* and *when* female appointments into top management teams (TMT) cause firms to change their approach to knowledge-related strategic renewal. In doing so, we reconcile the tension among extant mediating processes invoked to explain how female TMT representation might affect strategic decisions: change orientation and risk-taking propensity. Estimating a dynamic OLS model on panel data from 163 multinationals we find that following female (but not male) TMT appointments, TMT cognitions shift, becoming more change-oriented and less risk-seeking. Subsequently, these TMT cognitive shifts cause a decrease in M&A and an increase in R&D. Our model of female TMT appointments as catalysts that cause shifts in TMT cognitions, which, in turn, redirect knowledge-related strategic renewal from a buying to a building approach, is a novel effort at advancing research on women at upper echelons to examine time-dependent, within-firm mechanisms linking women in upper echelons and firm outcomes.

Keywords: Top management teams (TMT); Cognitions; Gender; Strategic Renewal; Upper Echelons

Theorizing that female executives bring unique knowledge, contribute distinct perspectives and foster productive team dynamics, upper echelons and gender researchers argue that the presence of women on a top management team (TMT) should improve firm-level outcomes. Supporting these ideas, meta-analyses reveal positive associations between female TMT representation and firm-level outcomes, most notably firm financial performance (Hoobler, Masterson, Nkomo, & Michel, 2018; Jeong & Harrison, 2016). Yet, these studies indicate that TMT composition explains just a fraction of variance in firm performance (Klotz, Hmieleski, Bradley, & Busenit, 2014), prompting scholars to theorize linkages between female TMT representation and more proximal organizational outcomes, such as the launch of new products or services (Lyngsie & Foss, 2017), management innovations (Heyden, Sidhu, & Volberda, 2018), or risk taking (Faccio, Marchica, & Mura, 2016).

However, even as researchers have moved to examine more proximal outcomes of female TMT representation, the question of *how* female TMT appointments affect them remains open (Gupta, Mortal, Chakrabarty, Guo, & Turban, 2020; Roberson, Holmes IV, & Perry, 2017), triggering calls for dynamic theory to establish causal pathways from executive gender to firm outcomes (Hoobler et al., 2018; Jeong & Harrison, 2016). For example, Jeong and Harrison, while providing meta-analytical evidence of a negative association between women in executive ranks and firm-level risk, encourage scrutiny of "the detailed mechanisms and nuanced arguments" underlying these relationships (2016: 1238). Without a dynamic approach, research on female leaders and firm outcomes remains descriptive ("what is the link?") when it needs to be explanatory ("how does the linkage occur")? This descriptive understanding of the female TMT – firm outcome linkage may set firms and female executives up for failure, if CEOs, executives, and board members believe that merely having women on a TMT causes favorable outcomes (Post, Wowak, & Ketchen, forthcoming) and are unaware of the unfolding TMT dynamics after women's appointments.

Further, a theoretical tension surrounds the mechanisms that scholars invoke to explain the associations between female representation and firm strategic choices. Some researchers conjecture that women's lower risk-taking propensity (relative to men's) and the effects of team diversity could explain female TMT representation's relationship to lower firm risk (e.g., Faccio et al., 2016). Other scholars speculate that women's propensity for transformation and the potential for female entrants into upper echelons to yield creative TMT thinking might explain positive links between female TMT representation and firm innovation (e.g., Furst & Reeves, 2008; Stainback, Kleiner, & Skaggs, 2016). These arguments seem to rest on paradoxical assumptions: how could women simultaneously be more open to change and also risk averse? As long as this theoretical tension remains unaddressed, researchers will selectively draw from either theoretical arguments, obscuring the full picture of how risk-aversion and propensity for change simultaneously shape the female TMT representation - firm strategy relationship (Cho & Hambrick, 2006).

The strategic renewal literature, which links *new executive TMT appointments* with *within-firm strategic change* (Barker III, Patterson Jr, & Mueller, 2001; Williams, Chen, & Agarwal, 2017), presents an opening for resolving these theoretical gaps and inconsistencies. Strategic renewal refers to the partial or full transformation of a firm's strategic capabilities (e.g., through refreshment or replacement) meant to alter an organization's path dependency and influence its long-term prospects (Agarwal & Helfat, 2009; Albert, Kreutzer, & Lechner, 2015). It is typically realized through one of two pathways: capability buying (e.g., M&A) or capability building (e.g., R&D investments) (Capron & Mitchell, 2009). Knowledge-based strategic renewal, an important driver of firm innovation, is the focus of our study.

The strategic renewal literature recognizes that new TMT appointments may shift a firm's strategic trajectory (e.g., from building to buying, or vice-versa) in a way that reflects the new TMT entrant's attitudes, values, and experiences (Barr, Stimpert, & Huff, 1992;

Eggers & Kaplan, 2009). Yet, despite the insight that decision makers' cognitions, shaped by their values and experiences, drive strategic decision-making (Carpenter, Geletkanycz, & Sanders, 2004; Hambrick, 2007), scholars of strategic renewal are still unclear about what factors trigger change and how (Schmitt, Raisch, & Volberda, 2018), having seldom examined how these changes unfold over time (Kunisch, Bartunek, Mueller, & Huy, 2017; Langley, Smallman, Tsoukas, & Van de Ven, 2013). To address this, we propose a gender-based model of strategic renewal, linking executive gender with the process (cognition shifts) and content (R&D, M&A) of incremental strategic renewal (Agarwal & Helfat, 2009), that explains what changes after women enter TMTs, and why.

Our dynamic model contributes to research on women in upper echelons, to upper echelons theory (UET), as well as to research on TMT renewal and strategic change in three major ways. First, it establishes *shifts in TMT cognitions* as a mechanism dynamically linking *female TMT appointments* with *strategic renewal*. By showing how the gendered nature of TMT renewal changes TMT cognitions from one year to the next and later produces strategic shifts, our longitudinal analysis offers a gender-based dynamic model of strategic change. Second, our model resolves the seemingly contradictory ways in which gender differences in change orientation and risk taking may affect organizational outcomes. Finally, our model extends UET and research on strategic change: not only does it answer the question of whether TMT appointments change TMT cognitions and, thereby, contribute to strategic change (Buyl, Boone, & Matthyssens, 2011b; Hambrick, 2007; Kunisch et al., 2017; Schmitt et al., 2018); it also identifies integration into the TMT as a boundary condition to this effect.

A MODEL OF FEMALE TMT APPOINTMENTS AND STRATEGIC RENEWAL

Our model builds on the strategic renewal literature and combines it with the UET insights that top decision-makers' cognitions shape a firm's strategy (Carpenter et al., 2004; Cho & Hambrick, 2006; Hambrick, 2007) to posit that, from year to year, the nature of new TMT

appointees (their gender) causes *changes* in TMT cognitions that, later, alter the pathway to strategic renewal. Specifically, we integrate new knowledge about female executives' career strategies to theorize *why* female TMT appointments cause firms to shift away from a buying towards a building approach to knowledge-related strategic renewal, and *when* such pathways are accentuated. Our baseline prediction, illustrated in Figure 1, is that after the appointment of a woman (but not after the appointment of a man) to a firm's TMT, TMT cognitions shift, becoming more change-oriented (H1) but also less inclined to risk taking (H2). Subsequently, these cognitive shifts modify the firm's renewal strategy, such that firms increase their building activity (R&D; H6) but decrease their buying activity (M&A; H7).

-- Insert Figure 1 about here --

We focus on two TMT cognitions as mediating mechanisms linking female appointments and strategic renewal: *TMT change orientation* and *TMT risk-taking propensity*. *TMT change orientation* refers to a TMT's tendency to experiment, promote novel ideas, and depart from established organizational practices (Lumpkin & Dess, 1996). Change orientation predicts higher inclination to initiate voluntary changes, lower resistance to trying out new products, more positive affective and motivational reactions to change (Oreg, 2003) and less reluctance to modify a firm's strategy (Hambrick, Geletkanycz, & Fredrickson, 1993). Psychologically, change orientation encompasses a long-term focus, psychological resilience, the ability to change one's mind, and a willingness to give up old habits (Oreg, 2003). It is associated with intellectual efficiency, ingenuity, curiosity, aesthetics, tolerance and depth (Connelly, Ones, Davies, & Birkland, 2014; Woo et al., 2014). Its long-term focus underpins change orientation because experimentation involves considerable trial and error, and thus a comfort with gradual or distant results (Dai, Maksimov, Gilbert, & Fernhaber, 2014). With its focus on experimentation and initiating change, we conceive of TMT change orientation as internally-oriented.

TMT risk-taking propensity refers to the TMT's generalized preference for strategic alternatives with higher risk, given an expected return (or, a lower need for assurance of success before committing to a given strategy) (Brockhaus Sr, 1980). Risk-taking propensity reflects executives' overestimation of the TMT's or the firm's capabilities (i.e., perceiving higher probability of success) and underestimation of the negative outcomes from potential failure (i.e., perceiving less costs from failure). In their review of managerial risk taking, Hoskisson and colleagues (2017) list core self-evaluations, narcissism, and overconfidence (but not change orientation) as the psychological properties associated with the managerial risk-taking cognitions. Risk-taking propensity is associated with more of a willingness to utilize personal relationships outside the firm (Opper, Nee, & Holm, 2017). Due to its overestimation of capabilities and of success probabilities, risk-taking propensity also reduces the felt need for risk-mitigation activities (Francis, Hasan, Hunter, & Zhu, 2017) and for strategic flexibility (Shimizu & Hitt, 2004). Higher risk-taking propensity typically comes with a focus on immediate opportunities, because the lower needs for assurance of success and lower perceived cost of failure accelerate action (Dai et al., 2014).

Because TMT change orientation and TMT risk-taking propensity are conceptually distinct, we argue that they will have distinctive effects on strategic renewal. Such distinctive effects have been reported in research that simultaneously examined the impact of openness to change and risk propensity on several firm outcomes (Lomberg, Urbig, Stöckmann, Marino, & Dickson, 2017; Lumpkin & Dess, 2001). In a study of manufacturing firms, firm-level change orientation was positively related to new product development performance, whereas firm-level risktaking was not (Frishammar & Åke Hörte, 2007). Another study of new ventures found firm-level risk-taking and change orientation to have, respectively, a negative and a positive U-shaped relationship with foreign market entry (Dai et al., 2014).

We focus concurrently on *changes* in M&A and *changes* in R&D as indicators of

shifts in renewal strategies, for two reasons. First, M&A and R&D epitomize not only two central (Arora, Belenzon, & Rios, 2014), but also two distinct TMT-level strategic decisions (Harrison, Hitt, Hoskisson, & Ireland, 1991). M&A represent a capability buying and resource-picking strategy, while R&D represent a capability-making and -building strategy, and both are not equally risky (Kacperczyk, Beckman, & Moliterno, 2015). While most firms engage in both M&A and R&D because of their complementarity in the achievement of corporate innovation (Cassiman & Veugelers, 2006), firms tend to focus more on one than on the other, rather than pursuing both with equal vigor (Bertrand & Schoar, 2003; Capron & Mitchell, 2009; Makadok, 2001), perhaps because the funding, and TMT time and attention required for one are diverted from the other (Hitt, Hoskisson, Ireland, & Harrison, 1991). The "dual importance of acquisitions and internal development as sources of value and innovation for a firm," (Karim & Mitchell, 2004: 542) underscores the importance of looking concurrently at R&D and M&A as key outcomes of TMT cognition shifts. Doing so enabled Fralich and Bitekine (2020), for example, to determine that higher-status CEOs engage in more M&A and less R&D. Second, firms appear to modify their relative investments in R&D and M&A as a result of TMT cognitions (Lungeanu, Stern, & Zajac, 2016). These foundational insights lead us to theorize distinct dynamic trajectories of strategic renewal from female TMT appointment to changes in M&A and R&D, via shifts in TMT risk-taking propensity and in TMT change orientation, respectively.

We further theorize that the relationships between female TMT appointments and subsequent shifts in TMT cognitions are moderated by TMT female incumbency, that is, the presence of women on the TMT to which females are appointed (H3 and H4 in Figure 1), and by the size of the cohort of new TMT appointees relative to the number of TMT incumbents in a given year (H5). We select these moderators as they affect the integration of new appointees into the TMT and such integration is central to the ability of new executives to

influence the TMT (Lubatkin, Simsek, Ling, & Veiga, 2006; Wang & Zatzick, 2019).

Female TMT Appointments Shift TMT Cognitions

Managers' cognitions are shaped by their innate capabilities and life experiences (Kish-Gephart & Campbell, 2015). While executives share similarities (all are expected to ensure a firm's competitiveness), they "have some leeway to vary the manner in which they carry out these expected activities […]. It is these elective and discretionary aspects of organizational behavior that may be the most likely to vary according to gender" (Eagly & Johannesen-Schmidt, 2001: 784). The existence of innate gender differences in capabilities is subject to debate. In contrast, the evidence concurs to indicate that women and men's distinctive life experiences fashion their paths to the C-suite (Glass & Cook, *2020;* Smith, Watkins, Ladge, & Carlton, 2019; Vial, Napier, & Brescoll, 2016).

Female executives are aware that, as female authorities, they have lower perceived status (Vial et al., 2016) and are less likely to be seen as a valued group member (Duguid, Loyd, & Tolbert, 2012). To prove their worth and gain acceptance, most female executives seek opportunities that enable them to "demonstrate breakout performance" (Smith et al., 2019: 1723), and promote "novel strategic vision around which they develop collective support" (Bowles, 2012: 195).

However, asserting dominance, aggressiveness, and competitiveness brings penalties to women, as these behaviors deviate from gender expectations (Vial et al., 2016). Further, women in upper echelons often occupy token positions (Kanter, 1977) where their success or failures are more highly visible and publicly monitored than men's (Gupta, Han, Mortal, Silveri, & Turban, 2018). Clearly, female executives understand that doubts about their competence and capabilities lead to high scrutiny of their behaviors and performance (Glass & Cook, *2020*). Increasing evidence suggests that women who reach corporate upper echelons have developed strategies to successfully navigate the male-dominated spaces, in

which they are both numerical minorities and lower-status members (Bowles, 2012; Glass & Cook, *2020;* Smith et al., 2019), balancing displays of aggressive/dominant and of cooperative/submissive leader behaviors (Vial et al., 2016). Further, because their performance needs to be flawless to avoid confirming stereotypes of female leaders' lesser competence, because of the career derailment risks that come with token-based hyper-visibility, and because of personal costs of constant scrutiny that come with making risky choices, women also carefully weigh the "perils of the risk strategy" (Glass & Cook, *2020: 10*). Indeed, when women are concerned with not being seen as a valued group member, they assess risks and losses more negatively (Mannor, Wowak, Bartkus, & Gomez-Mejia, 2016) and favor less risky gambles (Carr & Steele, 2010).

Given that 1) new TMT appointments often bring about shifts in a firm's strategic trajectory that reflect the new TMT entrants' attitudes, values, and experiences (Barr et al., 1992; Eggers & Kaplan, 2009), and 2) change orientation and risk taking are central to female executives' accession to corporate upper echelons (Fitzsimmons, Callan, & Paulsen, 2014), we expect female (but not male) executives' cognitions to increase TMT change orientation, while, at the same time, lower TMT propensity to take risks.

Following female TMT appointment, TMT change orientation increases. We expect TMT change orientation to increase for two reasons. First, because of their life experiences and path to the C-suite, female executives favor transformative organizational initiatives (Glass & Cook, *2020;* Vial et al., 2016). Thus, we expect women to exhibit behaviors and bring values that trigger more open-mindedness and change orientation in others. Empirical evidence supports our reasoning. Female (more than male) executives appear "driven more by a sense of purpose and a desire to contribute value and shape culture" (Stevenson & Orr, 2017); care less about tradition (Adams & Funk, 2012); and are slightly more likely to challenge the status quo (Zenger & Folkman, 2012). Women use transformational leadership

somewhat more than men (Eagly, Johannesen-Schmidt, & van Engen, 2003). These approaches, and the positive emotions that they entail, tend to inspire more of a change orientation in others (Huy, 2012), such as TMT peers.

Second, as female executives enter the TMT they may contribute different strategic perspectives from those of male TMT appointees and of male incumbents, because of sex-based differences in work and non-work experiences (Hillman, Cannella, & Harris, 2002) and in social networks (Ibarra, 1997). Greater variety of perspectives on strategic issues stimulates TMT peers to consider change (Wiersema & Bantel, 1992). It also causes the TMT to discuss a larger range of solutions to the strategic issues they face (Hambrick, 2007), which, in turn, "increases the probability that the issue will be perceived as feasible to resolve, in turn raising the momentum for change" (Dutton & Duncan, 1987: 290). Conversely, one expects no shift in TMT change orientation after the appointment of male executives to the TMT, given the expected similarity in transformational and conformist outlook, between a male TMT entrant and the TMT.

Hypothesis 1: When TMT appointments occur within a firm, following female (but not male) TMT appointments there is a subsequent increase in the TMT's change orientation.

Following female TMT appointment, TMT risk-taking propensity decreases. TMT risk-taking propensity after female TMT appointment is likely to decrease for two reasons. First, the entry into a group of more, or seemingly more, risk-averse individuals contributes to a cautious shift in the group's thinking as each member believes the group is more risk-averse than they are and downgrades their risk preferences accordingly (Masclet, Colombier, Denant-Boemont, & Loheac, 2009; Stoner, 1968). Female (but not male) TMT appointments may cause cautious shifts, as female executives, aware that their actions receive heightened scrutiny and that failures may be fatal to their career (Glass & Cook, *2020;* Gupta et al., 2018) favor less risky strategic alternatives (Faccio et al., 2016). Cautious shifts in the TMT

may also occur because of stereotypical expectations of women's higher risk-aversion (Eckel & Grossman, 2008), compared to men.

Second, when members with different belief structures enter the TMT, we expect executives to engage in more controlled (rather than automatic) decision-making (Dutton & Duncan, 1987) and in more discussions about how to process and integrate different perspectives and information. Such discussions reduce group biases (Kaplan, 2008), leading groups to make less risky decisions than group members would make individually (Adams & Ferreira, 2010). Because of females' actual or expected higher risk sensitivities relative to men, their entry (but not male entries) into the TMT may cause more discussion and exchange, triggering information elaboration and requiring the integration of different perspectives (Homan, Van Knippenberg, Van Kleef, & DeDreu, 2007). The new TMT dynamics for sharing information and making decisions are among those that contribute, from one year to the next, to alter TMT cognitions (Cho & Hambrick, 2006), reducing the risk-seeking propensity of the previously more male-dominated TMT (Jeong & Harrison, 2016). Taken together, these arguments bring us to predict:

Hypothesis 2: When TMT appointments occur within a firm, following female (but not male) TMT appointments there is a subsequent decrease in the TMT's risk-taking propensity.

TMT Integration: Boundary Conditions to the Influence of Female TMT Appointments on Subsequent Shifts in TMT Cognitions

We propose that TMT integration is a condition in which the unique values of new female TMT appointees have a better chance of being voiced, heard, and included in the TMT thinking process (Lubatkin et al., 2006: 652). Building on research on boundary conditions to the integration of new TMT appointees (Williams et al., 2017) and on newcomer socialization (Wang & Zatzick, 2019), we therefore theorize moderating influences of TMT female incumbency and of the size of the incoming cohort of appointees.

TMT female incumbency amplifies the shifts in TMT cognitions following female TMT appointments. Incumbents can help new TMT members more quickly understand the firm and the TMT (Simsek, Veiga, Lubatkin, & Dino, 2005; Williams et al., 2017). Based on social identity theory, which posits that individuals gravitate to and help similar-others, based on salient attributes, like gender (Riordan, 2000), we expect TMT female incumbency to amplify the shifts in TMT cognition that follow female TMT appointments, for two reasons.

First, TMTs with more female incumbents may be better prepared and able to integrate female TMT appointees. The integration of newly appointed executives into a TMT is challenging when the TMT lacks experience reconciling divergent values of its members (Buyl, Boone, Hendriks, & Matthyssens, 2011a; Williams et al., 2017; Zhang & Qu, 2016). TMTs with female incumbents are more likely to have experience with and have developed some aptitude for reconciling divergent values, especially values that women are likely to bring to the TMT. Relatedly, while stereotypes about women's capabilities (Fiske, 2002) may at first guide interactions of male-majority teams with token females, such stereotypes interfere less with team dynamics as those teams gain more exposure to women (Finseraas, Johnsen, Kotsadam, & Torsvik, 2016). Similarly, female TMT appointees may contribute and be heard more on TMTs when the TMT includes more women (Ely, 1995; Torchia, Calabrò, & Huse, 2011), a condition that attenuates stereotype threats and scrutiny (Gloor, Morf, Paustian-Underdahl, & Backes-Gellner, 2018).

Second, when the TMT has female incumbents, the TMT is more likely to think of the new female TMT appointee as an in-group member, that is, as similar to the rest of the TMT. Newcomer socialization and minority voice research both show that when newcomers seem more similar to old-timers, old-timers are more likely or quicker at integrating newcomers' input, and even their potentially unconventional views, into the team's decisions (Kane, 2010; Wood, Lundgren, Ouellette, Busceme, & Blackstone, 1994). Hence, we predict:

Hypothesis 3: When TMT appointments occur within a firm, there is an interaction effect between female (but not male) TMT appointments and TMT female incumbency on the subsequent shifts in TMT cognitions. Specifically, female TMT appointments combined with TMT female incumbency leads to a greater subsequent (a) increase in the TMT's change orientation and (b) decrease in the TMT's risk-taking propensity.

We expect the amplifying effect of incumbency on the relationship between TMT female appointments and TMT cognitions to decrease after TMT female incumbency reaches a given threshold, for two reasons. First, we reason that when TMT female representation exceeds the socially accepted threshold, the TMT is more likely to implicitly value having more female executives and to have access to a pipeline or network of female executives (Chang, Milkman, Chugh, & Akinola, 2019; Dezsö, Ross, & Uribe, 2016). Because such TMTs are more open to gender-diversity (You, 2019), we expect stereotypes about women to be muted and decision-making processes to be more inclusive on the part of all TMT members. This, in turn, would reduce the importance of female TMT incumbents beyond a certain threshold in integrating new female members to the TMT. Second, when female incumbency is high, TMT cognitions are likely to already have been altered by the female incumbents when they were first appointed, such that there will be diminishing returns to new female TMT appointments. For both of these reasons, we expect:

Hypotheses 4a and 4b: The moderating effects of TMT female incumbency described in H3a and H3b are attenuated at high levels of TMT female incumbency.

Smaller (relative) cohort sizes of incoming TMT appointees amplify the shifts in TMT cognitions following female TMT appointments. We propose that the predicted shifts in TMT cognitions that follow female TMT appointments are greater when female TMT appointees are part of a smaller (rather than larger) cohort of new TMT appointees, because integration becomes increasingly difficult with larger cohorts of new entrants, relative to

incumbents. Two issues associated with cohort hiring could attenuate the effect of female TMT appointments. First, higher ratios of new TMT appointees to incumbents can spur competition for scarce resources and power struggles on the TMT (Michel & Hambrick, 1992; Wang & Zatzick, 2019). Larger cohorts of new appointees may represent a threat to the incumbent TMT, impeding the integration of appointees into the TMT, thereby dampening the effect that we predict for female TMT appointees to alter TMT cognitions. Second, individuals who enter the TMT together may feel they have more in common with each other than with the rest of the TMT, creating subgroups, which hampers TMT integration (McCain, O'Reilly, & Pfeffer, 1983).[1] Hence, we propose:

Hypothesis 5: When TMT appointments occur within a firm, there is an interaction effect between female (but not male) TMT appointments and the size of the cohort of new TMT appointees on subsequent shifts in TMT cognitions. Specifically, female TMT appointments combined with a small (compared to a large) cohort of new TMT appointees leads to a greater subsequent (a) increase in the TMT's change orientation and (b) decrease in the TMT's risk-taking propensity.

Shifts in TMT Cognitions: The Dynamic Link between Female TMT Appointments and Strategic Renewal

As R&D and M&A present unique risk and visibility profiles, which factor into the calculation of which strategy to pursue (Fralich & Bitektine, 2020), we theorize distinct dynamic trajectories of strategic renewal from female TMT appointments to M&A and R&D, via the proposed effects of female TMT entrants on TMT cognitions.

Female TMT appointments indirectly increase R&D via a rise in TMT change orientation. R&D are discretionary firm expenditures that reflect explicit executive decisions

[1] The composition of an incoming cohort of new TMT appointees may further moderate the effect of female TMT appointees in a given year. We explore this possibility in two post-hoc analyses, because small numbers in this population preclude us from conducting robust analyses of such effects.

to engage with innovation as a capability-making and -building strategy (Bromiley, Rau, & Zhang, 2017; Ketchen Jr, Ireland, & Baker, 2013), notably by investing in scientists and engineers (Goolsbee, 1998), but also in new R&D labs or internal product development. As such, R&D investments are: often reversible and controllable; may involve fewer and less binding contracts; their integration with existing capabilities can be planned and coordinated (Ketchen Jr et al., 2013); and they may help firms better scan and evaluate their environment for risks and opportunities (Cassiman & Veugelers, 2006).

We expect female (but not male) TMT appointments to be associated with later increases in R&D via an increase in TMT change orientation for the following reasons. First, as conceptualized, TMT change orientation is the tendency to experiment with novel ideas (Lumpkin & Dess, 1996). It involves a focus on the long term (Oreg, 2003) and a comfort with gradual or distant results (Dai et al., 2014). Because R&D investments are a capability building pathway to strategic renewal, and therefore, require being at ease with, and confidence in long term results, it stands to reason that, as TMT change orientation increases, so does the TMT's preference for R&D investment. This may be why TMTs with a stronger change orientation seem more likely to believe in the capability of the firm to find new opportunities by itself (Hamel & Prahalad, 1994) and think of R&D as having a higher potential for uncovering new ideas (Gruber, MacMillan, & Thompson, 2012). Furthermore, creative TMTs create better conditions for exploring (Makri & Scandura, 2010) and integrating new ideas and knowledge (Caridi-Zahavi, Carmeli, & Arazy, 2016). More change-receptive TMTs also seem to support long-term commitments to innovation (Hitt, Hoskisson, & Ireland, 1990), and see the value in developing and maintaining capabilities to assimilate and exploit knowledge (Cohen & Levinthal, 1989), which suggests they may favor R&D. Indeed, leaders who are receptive to change facilitate more generative and exploratory thinking processes (Howell & Higgins, 1990; Jung, Wu, & Chow, 2008), promote the

application of knowledge and expertise to bring about new projects and initiatives (Caridi-Zahavi et al., 2016), and develop technological leadership (Kollmann & Stöckmann, 2014), all of which require R&D investments. Therefore, we propose:

Hypothesis 6: Following female TMT appointments, the greater the increase in TMT change orientation, the greater the subsequent increase in R&D.

Female TMT appointments indirectly reduce M&A via a drop in TMT risk-taking propensity. M&A require substantial financial resources, heightening firms' financial risk (Hitt, Hoskisson, & Kim, 1997; Thaler, 1992). The high rate of M&A failure (Cartwright & Schoenberg, 2006; Malhotra, Reus, Zhu, & Roelofsen, 2018) also creates considerable risk, because of the difficulties in integrating new capabilities into the firm and appropriating value (Gulati & Singh, 1998). Further, M&A are highly visible strategic moves that, given their proneness to failure, bring considerable career risk to the executives associated with them (Pablo, Sitkin, & Jemison, 1996). To be sure, M&A can also serve as risk-mitigating strategies, for example, enabling diversification (Cain & McKeon, 2016). Still, when, as is the case with M&A, the expected outcomes of a decision are more uncertain, the decision goals more difficult to achieve, and the potential outcomes more extremely consequential, then the decision carries much more risk, increasing the likelihood that key stakeholders would be disappointed (Sitkin & Pablo, 1992) should M&A fail.

Given the high stakes associated with M&A, we expect fewer M&A to occur after the drop in TMT risk-taking propensity for two reasons. First, as a TMT's risk-taking propensity drops, its need for assurance of success before committing to a given strategy will increase (Brockhaus Sr, 1980). Due to the TMT's cautious shift, executives may collectively come to see more downsides to M&A opportunities and feel more pessimistic about their potential outcomes (Pablo et al., 1996), attending less closely to information about M&A opportunities (Helfat & Peteraf, 2015). Supporting the idea that TMT risk-taking propensity influences

M&A, studies of CEOs (e.g., Cain & McKeon, 2016; Leung, Tse, & Westerholm, 2019; Levi, Li, & Zhang, 2010) find that those with higher risk-aversion make fewer M&A. Second, even when risk-seeking executives remain on the TMT, they tend to relinquish leadership in group decisions as the group's risk-taking propensity decreases (van Knippenberg, Van Knippenberg, & van Dijk, 2000), suggesting a diminishment of influence from the most risk-seeking TMT members after the TMT's risk-propensity declines:

Hypothesis 7: Following female TMT appointments, the greater the decrease in TMT risk-taking propensity, the greater the subsequent decrease in M&A.

METHOD

Data and Sample

We test our model with a sample of 163 multinational firms headquartered in 20 OECD countries and representing multiple industries. We selected, for each industry, firms with the largest sales presence in the European market. All are actively involved in strategic innovation (e.g., technology-based M&A and firm R&D) during the observation period, 1998-2012. We focus on European market leaders because of our access to secondary data from the European Commission (Belderbos, Sleuwaegen, & Veugelers, 2010) initially gathered to examine the relationship between technology and market leadership in Europe.[2]

Our sample allows for a wide generalizability of our findings. Because the firms in our sample represent countries and industries with a range of female representation in top leadership positions, it accounts for country- and industry-level differences in female TMT appointments (Ernst & Young, 2013; McKinsey&Company, 2016). Further, the sample accounts for varying degrees of executive influence across national contexts (Crossland &

[2] Published studies using data from some firm-years in our sample have evaluated the role of power distance and TMT stratification in the link between TMT nationality diversity and corporate entrepreneurship (Boone, Lokshin, Guenter, & Belderbos, 2019) and the relationship between geographic diversity of corporate venture capital investments and corporate technological performance (Belderbos, Jacob, & Lokshin, 2018). While those studies drew on 1998-2007 and 2001-2007 data respectively, our sample extends to firm data for years 1998-2012. In Table 1, we indicate the variables in our model for which some overlap with these studies exits.

Hambrick, 2011). Appendix A lists all industries and firms in our sample.

We identified the top executives of the focal companies during the sample period from annual reports and retrieved their demographic and job-related information from BoardEx. In total, we gathered information on over 4,000 TMT members. Consistent with extant TMT studies (e.g., Michel & Hambrick, 1992), we defined TMT membership as having the rank of Vice President (Chairman, Vice Chairman, Chief Executive Officer, Chief Financial Officer, Chief Technology Officer, Chief Operating Officer, Executive Vice President, Senior Vice President) or holding a board executive directorship. We derived our change orientation and risk-taking propensity measures from letters published in firms' annual reports. In total, we extracted and analyzed nearly 2,000 letters to the shareholders (LTS). Compustat and Datastream supplied firm-level data. We located firms' M&A activities in the SDC and the Zephyr databases. Patent applications data came from the European Patent Office's PATSTAT database. We gathered two country-level data, female representation in senior and middle management positions and the gender gap index, from the ILO database and World Economic Forum report, respectively.

Dependent Variables

TMT change orientation and TMT risk-taking propensity. To measure TMT cognitions, we rely on prior work demonstrating that TMT qualities manifest, in part, in the language executives adopt (Abrahamson & Hambrick, 1997; Duriau, Reger, & Pfarrer, 2007; Levy, 2005). We used LIWC software (Pennebaker, Chung, Frazee, Lavergne, & Beaver, 2014) to content analyze the sample firms' LTS: we counted the percentage of words capturing the constructs of risk taking (e.g., audacious, precarious) and of change orientation (e.g., create, transform) using dictionaries compiled and validated for this purpose by Short, Broberg, Cogliser, and Brigham (2010) and by McClelland, Liang, and Barker III (2010), respectively

(see Appendix B)[3]. We transformed our dependent variables by taking the *first difference* (from year t-1 to t), to capture *changes* in TMT cognitions. If the letters used none of the words from the dictionaries, we censored at zero our measures of TMT cognitions.

While we recognize that LTS carry symbolic and persuasive elements (e.g., targeted at securities analysts), our measures still serve as valid, albeit imprecise, proxies of TMT cognitions for several reasons (Cho & Hambrick, 2006; Gerstner, König, Enders, & Hambrick, 2013). First, the content of LTS is collectively produced, and, therefore, at least partially reflects the cognitions of the entire TMT (Engelen, Neumann, & Schmidt, 2016; Shin & You, 2017). In other words, they can be regarded as TMT-level measures. While CEOs sign the LTS and public relations specialists help write them, executives negotiate the content of (Gerstner et al., 2013; Marcel, Barr, & Duhaime, 2011), provide input into (Cho & Hambrick, 2006), and carefully edit the language of the LTS (Abrahamson & Hambrick, 1997). Further, triangulation studies show that the cognitive measures obtained from LTS mirror measures sourced from other TMT cognitions data (D'Aveni & MacMillan, 1990), and that changes in a firm's TMT correlate with changes in the style, length, and content of the LTS (Eggers & Kaplan, 2009). Finally, LTS have previously served to derive such measures of TMT cognition as entrepreneurial attention (Cho & Hambrick, 2006), causal logics (Nadkarni & Barr, 2008), and TMT exploratory and exploitative attention (Buyl, Boone, & Wade, 2015). Therefore, it is reasonable to expect that collecting cognition data from LTS yields valid TMT cognition measures. Second, because our measures stem from a long series of LTS for each focal firm, they are not prone to selection issues due, for example, to respondent attrition or turnaround over time. As Kaplan summarized, "It was the development of the Letter to Shareholders, and specifically word counts of themes within

[3] We also used CATScanner as an alternative algorithm to analyze the content of the LTS because the algorithm used might be a source of error variance (McKenny, Aguinis, Short, & Anglin, 2018). However, the very high correlations between the LIWC and CATScanner measures, 0.93 and 0.97 for TMT change orientation and TMT risk-taking propensity respectively, reveal that this is not an issue in our study.

them, as a legitimated measure of managerial cognition that made it possible to proceed with longitudinal studies connecting cognition to action" (2011: 679).

Computer-based content analysis has limitations that pose construct validity challenges (Belderbos, Grabowska, Leten, Kelchtermans, & Ugur, 2017). To check the construct validity of the TMT risk-taking propensity variable, we examined its relationship with firm-specific risk (Cheng, Hong, & Scheinkman, 2015; Wright, Kroll, Krug, & Pettus, 2007). Volatility in shareholder returns (RTS), a stock market measure, was calculated as a month-end stock price minus the previous month-end stock price, divided by the previous month-end stock price and averaged for each year (Hoskisson et al., 2017). Consistent with our logic we find that TMT risk-taking propensity is significantly positively related to firm risk (0.07, p=0.00), while TMT change orientation is not (-0.04, p=0.11).

To check the validity of our TMT change orientation measure, we examined its relationship with a related construct, innovation orientation (Short et al., 2010). We content analyzed the focal LTS and applied the dictionary developed and validated by Short et al. (2010). TMT innovation orientation is strongly correlated (0.71, p=0.00) with our TMT change orientation measure (but not with risk-taking propensity, -0.01, p=0.69) which resonates with prior studies (Simsek, 2007; Wu, Levitas, & Priem, 2005). These analyses underscore the validity of our TMT cognition measures. Finally, in Appendix C we present three examples of LTS illustrating the face validity of the word lists that we employed to measure TMT change orientation and risk-taking propensity.

Change in M&A activity and in R&D. To capture *within-firm change* in M&A activity we computed, for each focal firm, the first-difference (from t to t+1) of the annual count of technology-based M&A (i.e., target firms with patent activities) (Malhotra et al., 2018; Vermeulen & Barkema, 2001). *Within-firm change* in R&D is the yearly growth of the focal firm's R&D stock. R&D expenditures reported in balance sheets comprise both new

and replacement R&D. Each year some of the R&D stock depreciates and, therefore, part of the R&D investment each year simply replenishes this R&D stock. If each year's R&D investment only replenishes the depreciated R&D, the total R&D stock of the firm would remain the same. In contrast, and consistent with our theorizing, our dependent variable represents the yearly growth of the R&D stock, beyond replenishment and depreciation.[4]

Focal Independent and Moderating Variables

Female and *Male TMT appointments* are the counts of female and male executives who represent new additions to the TMT in a given year (c.f., Williams et al., 2017).

TMT female incumbency is the total number of women on a TMT, lagged by one year (i.e., in a year preceding the year in which a new appointment occurred). Following Wang and Zatzick (2019), we calculated the (relative) *size of the cohort of incoming TMT appointees* by dividing the total male and female new TMT appointments during a year by the number of TMT members in the previous year.

Control Variables

Our analyses control for time-variant characteristics of CEOs, TMTs, firms and countries, some of which were variables in studies published with subsets of our data (see Table 1). To estimate dynamic models, all control variables, unless noted otherwise, are in *first differences* (from year t-1 to t), accounting for the change in these characteristics in all models.

CEO controls. We include *CEO tenure* and *CEO age*.

TMT-level controls. We used top executives' country of origin to construct *TMT*

[4] We follow an approach often adopted in the innovation literature to estimate an investment equation of R&D (Chirinko, Fazzari, & Meyer, 1999). Investment in R&D for firm *i* at time *t* is composed of replacement investment ($R^r_{i,t+1}$) and net investment ($R^n_{i,t+1}$). The former is proportional to the R&D capital stock at the beginning of the period: $R^r_{i,t+1} = \delta K_{i,t}$. The latter represents the change in the R&D stock: $R^n_{i,t+1} = K_{i,t+1} - K_{i,t}$.Hence we can write our dependent variable in models 15-17 as: $\frac{R_{i,t+1}}{K_{i,t}} = \frac{R^r_{i,t+1}+R^n_{i,t+1}}{K_{i,t}} = \delta + \frac{\Delta K_{i,t+1}}{K_{i,t}}$. We construct the knowledge capital $K_{i,t+1}$ produced by R&D investments $R_{i,t+1}$ using the perpetual inventory method with a single depreciation rate taken to be 15% as in Chirinko et al. (1999) using the formula $K_{i,t+1} = (1-\delta)K_{i,t} + R_{i,t+1}$.

nationality diversity – a Blau index of the degree of TMT nationality diversity, because national origin may shape executives' attitudes and cognitions (e.g., Carpenter & Fredrickson, 2001). To control for TMT *social stratification* (e.g., Hambrick, Humphrey, & Gupta, 2015) we standardized and averaged two indicators based on the presence of different hierarchical rank titles in TMTs: (i) a count of title gradations per TMT as explained above (e.g., Chief Executive Officer, Chief Financial Officer) in the TMT in each year and (ii) the presence of a COO reflecting an additional hierarchical level in the TMT. The models include *TMT size*, measured as the number of TMT members. We control for *female board representation,* as the number of female supervisory directors may influence TMT change orientation and risk-taking propensity. All models control for LTS length, measured in words.

Firm-level controls. We include *firm size,* the logarithm of firm employees, to account for potential resource scale and market power effects. *R&D intensity* is R&D expenditures divided by sales. *Degree of product diversification*, measured as Blau index of product segmentation, controls for other aspects of firm strategic change[5].

Industry-level controls. The sampled firms operated in (1) food, beverages, & tobacco; (2) chemicals; (3) pharmaceuticals; (4) rubber, paper, glass, & mineral products; (5) metals; (6) electronics; (7) electrical & household equipment; (8) machinery; (9) automotive; (10) other transport equipment; (11) software; (12) telecommunications; and (13) miscellaneous industries. We used 12 dummy variables to control for any industry differences in the effects of female TMT appointments (Ali, Ng, & Kulik, 2014).

Country-level controls. Because societal disparities between men and women may influence the strength of women's influence at upper echelons (Hoobler et al., 2018; Post & Byron, 2015), we control for such disparities, with the *gender gap* index (World Economic

[5] We considered additional control variables such as Δ TMT diversity in intl. work experience, ΔTMT functional diversity, ΔTMT tenure diversity, ΔROA, ΔGeographic diversity of R&D, ΔGeographic diversity of firm sales, which appear to have weak explanatory power. For the sake of parcimony, we excluded these variables form the final models, but can confirm the robustness of the results to the inclusion of these variables.

Forum, 2015). We also control for country-level variations in the availability of female TMT candidates in the country's labor market by including *women in management*, i.e., female representation in senior and middle management positions, as reported in the ILO database.

Analytical Strategy

We estimate dynamic OLS models on an unbalanced panel (i.e., not all firms have the same number of observations) of 1,911 observations on 163 firms from 1998 to 2012. Historical annual reports were missing for some firms in some years: on average, we observe firms for 11.7 years. We control for unobserved heterogeneity by way of fixed industry effects, and by taking the first difference of our time-varying explanatory variables at the CEO, TMT, firm, industry and country level, all lagged by one year. Thus, all models are truly dynamic as within-firm changes in the dependent variables are linked to within-firm changes in TMT appointments, while controlling for within-firm changes in relevant control variables. (Appendix D lays out the full model derivation.)

To test Hypotheses 1 to 4, we include past levels of *TMT change orientation* and *TMT risk-taking propensity*, implying that we model temporal shifts in TMT cognitions as a partial adjustment process. As the nature of TMT cognitions might be path dependent, including past levels of TMT cognitions in the model allows for a gradual temporal adjustment of TMT cognitions, following an external event (i.e., TMT appointments), due to 'regression to the mean' (e.g., Greve, 1999).

To test the moderation effects in Hypotheses 3 and 5, we estimate TMT change orientation and TMT risk-taking propensity models on different sub-samples: low (zero) versus high (positive) TMT female incumbency, and small (below the sample mean value 0.14) versus large (above the sample mean value 0.14) relative size of the cohort of incoming TMT appointees. A sub-sample approach generates the most straightforward insights into the chain of effects from female appointments to strategic renewal, because it puts no restrictions

on the coefficients of the other covariates and allows the influence of all variables to differ across different integration settings, which is not the case with models specifying multiplicative interaction effects. We report the Chow tests on the differences in coefficients between the subsamples in a later section. To investigate if the moderating effect of female incumbency diminishes at high levels of incumbency (Hypotheses 4), we estimate threshold interaction effects. To test the mediating effects of TMT cognitions in Hypotheses 6 and 7, we follow a standard instrumental variable approach because TMT risk-taking propensity and TMT change orientation – our focal explanatory variables in the M&A and R&D models – are endogenously determined[6]. We do so by taking the predicted values of shifts in TMT cognitions obtained in the first stage in models testing Hypotheses 1 and 2 (Table 2, models 3 and 4), before testing their effects in the M&A and R&D models. Our results hold when using a structural equation modeling approach, as we detail in the robustness checks section.

RESULTS

The firms in our sample employ, on average, 84,000 employees and have at least one patent during the study period. Average TMT size is about 11. Firms from the U.S., about a third of our sample, have larger TMTs compared to the EU firms. All TMTs are male-dominated, ranging from 100% male to about 56%, with an average of almost 94%. We identified 2,771 TMT appointments, of which 276 (10 percent) were female appointments. The majority of observations in our sample (62.2%) are firm-year observations with zero female incumbency. Additionally, while in 17.2% of cases there is exactly 1 female incumbent, there are 2 female incumbents in 10.1% of cases, 3 female incumbents in 3.9% cases, and 4 or more female incumbents in 6.7% of cases. Of the 163 firms in our sample, 160 firms (1163 observations)

[6] The exclusion restrictions (instruments) are the past levels of cognition. Employing instrumental variables approach, such as Two-Stage Least Squares (2SLS) estimator, relies on similar assumptions as the structural equation model (SEM), and is a suitable approach for causal inferences in panel data designs (Eshima & Anderson, 2017; Otter, Pachali, Mayer, & Landwehr, 2018; Preacher, 2015). We obtain similar outcomes when estimating our models with SEM.

made at least one TMT appointment during the study period. On average, 1.5 appointments happened per year and a firm experienced a TMT appointment in 61% of the years. In our sample a (relatively) small cohort corresponds to adding 1 or 2 new executives to the TMT and a large cohort means adding 2 to 4 new executives, depending on the size of the TMT[7]. The sample average of TMT change orientation is 0.50 and that of TMT risk-taking propensity is 0.07. As we theorized, change in TMT risk-taking propensity and change in TMT change orientation are not significantly correlated (0.03, p-value=0.16), and neither are change in M&A and R&D growth (0.01, p=0.64). Table 1 provides all descriptive statistics and pairwise correlations, which are mostly low to moderate. The mean variance inflation factor (VIF) for the variables used in the estimation (1.21) is below the commonly used threshold of 10 (Cohen, Cohen, West, & Aiken, 2003).

-- Insert Table 1 about here --

Table 2 shows the results of our tests of Hypotheses 1 and 2. Supporting Hypothesis 1, results in Table 2 (model 3) show that female TMT appointments increase TMT change orientation (b=0.051, p=0.018), while male TMT appointments do not (b=-0.003, p=0.479). Wald test indicates that the difference between these coefficients would likely not have arisen if the effects were the same (p=0.017). Supporting Hypothesis 2, the female TMT appointments coefficient is significant (b=-0.009, p=0.025) and the male TMT appointment coefficient is not (b=-0.001, p=0.361) in the TMT risk-taking propensity model (Table 2, model 4). Wald test indicates that the coefficients for female and male TMT appointments in model 4 are statistically different, with a marginally significant p-value of 0.079. The estimated coefficients imply that female TMT appointments, on average, decrease TMT propensity to take risk by 13.5 percent and increase TMT change orientation by 10.2 percent.

[7] In about 1% of our sample observations we observe a larger incoming cohort triggered by a major acquisition by a focal company (e.g. HP acquisition of Compaq, P&G acquisition of Gilette). Our results are not sensitive to removing these observations.

-- Insert Table 2 about here –

To test Hypothesis 3a and 3b, we estimated TMT change orientation and TMT risk-taking propensity models separately for the zero and the positive TMT female incumbency sub-samples. In the TMT change orientation model, when female incumbency is zero (Table 3, model 5), the coefficient for female TMT appointments is marginally significant (b=0.042, p=0.093), while the effect of male appointments is insignificant (b=0.004, p=0.412) and the difference in the two estimated coefficients is not significant. Conversely, when female incumbency is positive (Table 3, model 6), the female TMT appointment effect gains in size and significance (b=0.059, p=0.035), whereas the male TMT appointment coefficient does not (b=-0.009, p=0.254) and the difference in the two estimated coefficients becomes significant (p=0.029). This pattern of findings is consistent with Hypothesis 3a, although a Chow test comparing the effect sizes of the female appointments across models 5 and 6 reveals that the difference is not significant (p=0.60). The results suggest that for TMTs with female incumbents, female TMT appointments, on average, increase TMT change orientation by 10.4 percent. Figure 2, Panel 1A illustrates the marginal effect.

In the TMT willingness to take risk model, when female incumbency is zero (Table 3, model 7), the estimated coefficients for both female and male TMT appointments are insignificant (b=0.006, p=0.557 and b=-0.000, p=0.936, respectively). Conversely, and supporting Hypothesis 3b, when female incumbency is positive (Table 3, model 8), the female TMT appointment coefficient becomes significant (b=-0.013, p=0.003), whereas the male TMT appointment coefficient remains insignificant (b=-0.002, p=0.280), and according to the Wald test, the female and male TMT appointment coefficients are different (p=0.034). A Chow test comparing the estimated coefficients for female TMT appointments under no incumbency and incumbency conditions is marginally statistically significant (p=0.085). These results suggest that when there is TMT female incumbency, a female TMT

appointment decreases TMT risk-taking propensity by 19.5 percent. Figure 2, Panel 1B graphically compares the marginal effects of appointing 0, 1 or 2 women to TMTs with female incumbents (solid line) and to TMTs without female incumbents (dotted line).

-- Insert Table 3 and Figure 2 about here --

To test Hypotheses 4, we estimated differing slopes on female TMT appointments, relying on interactions with dummy variables. The first dummy takes the value of 1 (else zero) if no woman was sitting on the TMT prior to the female TMT appointment. The second dummy variable takes the value of 1 (else zero) if there was exactly one female TMT incumbent, the third dummy takes the value of 1 (else zero) if there were exactly two, the fourth dummy takes value of 1 (else zero) if there were exactly 3 and the final dummy takes value 1 (else 0) if there were four or more female incumbents on a TMT. We then re-estimated our models including these interactions (threshold) effects. Our analyses (Table 4, model 9) reveal that female TMT appointments shift TMT change orientation when there is exactly one other woman present on a TMT (b=0.136, p=0.029), while interactions with the other dummy variables fail to reach the conventional levels of significance. Wald test cannot reject the equality in these estimated coefficients ($\chi^2_{\beta1=\beta2}$= 2.1, p=0.15; $\chi^2_{\beta2=\beta3}$= 0.08, p=0.78; $\chi^2_{\beta3=\beta4}$=0.00, p=0.96). Hence, as it relates to shifts in TMT change orientation, while the pattern of results is consistent with H4a, the evidence for diminishing returns to female TMT appointments at high levels of female TMT incumbency does not reach conventional levels of statistical significance. Results in Table 4, model 10 reveal that female TMT appointments begin to shift TMT risk-taking propensity when there is at least one other woman present on a TMT (b=-0.020, p=0.038). The impact of new female appointments is highest in absolute value, and is statistically significant (b=-0.029, p= 0.005) when there are exactly two incumbent women on a TMT, and with higher incumbency (four or more women), female TMT appointments no longer have a significant statistical association with

TMT willingness to take risk. Wald test rejects the equality only in the last pair of the estimated coefficients ($\chi^2_{\beta 1=\beta 2}$= 0.40, p=0.53; $\chi^2_{\beta 2=\beta 3}$= 0.81, p=0.37; $\chi^2_{\beta 3=\beta 4}$=5.76, p=0.02). Here, the pattern of results matches our expectation for a diminishing return of female TMT appointments to changes in TMT risk-taking propensity when female TMT appointments are high (H4b), but we only observe a statistically significant drop in returns when the TMT has four or more female incumbents.

-- Insert Tables 4 and 5 about here --

We test Hypothesis 5a by comparing the influence of female and male TMT appointments on TMT risk-taking propensity in small- and large-size incoming TMT cohort sub-samples. In the TMT change orientation model, the estimated coefficient of female TMT appointments becomes bigger and is marginally significant (b=0.095, p=0.053) when the size of the incoming TMT cohort is small (Table 5, model 11), compared to the smaller and insignificant coefficient in model 12 when the incoming TMT cohort is large (b=0.028, p=0.251). The Wald test comparing female and male TMT appointment coefficients suggests a stronger differential effect of female TMT appointments in model 11 (p=0.063) than in model 12 (p=0.147). These findings are consistent with Hypothesis 5a, although a Chow test comparing the effect sizes of the female TMT appointments across models 11 and 12 reveals that the difference does not meet conventional levels of statistical significance (p=0.211). We illustrate the marginal effects in Figure 2, Panel 2A.

In the risk-taking propensity model, the female TMT appointment coefficient is bigger and significant (b=-0.022, p=0.002) when the size of the incoming TMT cohort is small (Table 5, model 13), compared to the (non-significant) coefficient in model 14 when the incoming TMT cohort is large (b=-0.003, p=0.501). The male TMT appointment coefficient is insignificant in all models and the Wald test comparing female and male TMT appointments suggests a stronger differential effect of female TMT appointment in model 13

(p=0.005), but not in model 14 (p=0.566). The difference in the effect sizes of female TMT appointments in models 13 and 14 is statistically significant (p=0.029). This pattern of findings supports Hypothesis 5b. The estimated coefficient in model 13 suggests that when the incoming TMT cohort is small, female TMT appointments decrease TMT risk-taking propensity by 28.2 percent. Figure 2, Panel 2B graphically compares the marginal effects of appointing 0, 1 or 2 women when the cohort of incoming TMT executives is relatively small (dotted line) versus when it is large (solid line).[8]

Hypothesis 6 anticipated that, following female TMT appointments, R&D grows via an increase in TMT change orientation. Supporting Hypothesis 6 (Table 6, model 17), the estimated coefficient for the predicted shift in TMT change orientation (obtained from model 3 in Table 2) is statistically significant (b=0.059, p=0.041). That is, our model predicts that a large shift (one standard deviation increase) in TMT change orientation increases R&D stock by 1.1%. As the sample mean of R&D stock is 6,538 million, a 1.1% increase is substantial.

Hypothesis 7 postulated that, following female TMT appointments, M&A activity decreases via a drop in TMT risk-taking propensity. Supporting Hypothesis 7 (see model 20), the coefficient for the (predicted) shift in TMT risk-taking propensity (obtained from model 4 in Table 2) is statistically significant (b=1.419, p=0.016). A large shift (e.g., one standard deviation increase) in TMT risk-taking propensity corresponds to a 10.1% increase in the likelihood of an additional M&A, indicating, conversely, a reduced likelihood of engaging in more M&A activity for TMTs who have become less prone to risk taking.

-- Insert Table 6 about here –

To assess whether the shifts in TMT cognitions in fact mediate the relationships

[8] We performed two post-hoc analyses to explore in more detail how the structure of TMT female incumbency and the composition of the cohort of TMT appointees in a given year affect the relationships between female TMT appointments and TMT cognition shifts. Our first post-hoc analysis explores whether the impact of female TMT appointments becomes stronger when more than one woman concurrently join the TMT. Our second post-hoc analysis explores whether the effect of female TMT appointments on TMT cognition shifts gets bigger or smaller when female and male executives are co-appointed. Appendix H presents the posthoc analyses results.

between female appointments and strategic outcomes, we use the procedure described in Preacher, Rucker and Hayes (2007). Because we have moderated mediations, we use the predicted change in TMT risk-taking propensity and TMT change orientation from models 6 and 8 for the incumbency moderator (and from models 11 and 13 for the cohort size moderator) in the M&A and R&D models. Using bias-corrected confidence intervals for the two indirect effects (e.g., Eshima & Anderson, 2017; Wales, Patel, & Lumpkin, 2013), we find that the indirect effects of female TMT appointments (i) on R&D, via a rise in TMT change orientation, and (ii) on M&A, via a drop of TMT risk-taking propensity are statistically significant (z=0.003, p=0.038; z=-0.019, p=0.049, respectively) when TMT female incumbency is positive. We also find that the indirect effects of female TMT appointments (i) on R&D, via a rise in TMT change orientation, and (ii), on M&A, via a drop of TMT risk-taking propensity are marginally statistically significant (z=0.006, p=0.088; z=-0.032, p=0.075, respectively) for small incoming TMT cohorts.

Given the difficulties, statistically, in detecting moderated mediation in analyses relying on coarse-grained, secondary data that measure within-firm changes over time, we interpret our pattern of findings as consistent with our theory that female TMT appointments affect strategic renewal, at least partially, via shifts in TMT cognition, conditional on TMT female incumbency and on the (small) size of the incoming TMT cohort.

Robustness Checks

Our first robustness check addresses the possibility that endogeneity or selectivity affects our results. Female TMT appointments may be conditional on whether there is any new entry in a TMT. For example, firms with poor past performance may experience more executive turnover (Zhang & Rajagopalan, 2004) and more readily appoint women to the C-suite (Ryan et al., 2016). To address this possibility, we re-estimated our models on the subsample of our data when TMT appointments occur. Overall, the results do not suggest that endogeneity or

selectivity bias our results (see Appendix E). Our second robustness check assessed the indirect paths from TMT appointments to corporate strategies using structural equation modelling (SEM/GSEM commands in Stata 15) (Aguinis, Edwards, & Bradley, 2017). The structural equations recursive model differs from our two-step approach in that it allows for correlations among the error terms of our first-differenced equations. The SEM results are largely similar to our reported results. Only two of the six estimated residual correlations are (marginally) statistically significant, confirming the validity of our approach (Appendix F).

Finally, to further investigate the construct validity of our cognition variables, we re-estimated the models in Table 3 substituting the focal dependent variables, TMT change orientation and risk-taking propensity, with firm-specific risk and innovation orientation, respectively. As expected, we find that TMT female appointments significantly reduce firm-specific risk, especially when there is female incumbency (Appendix G). When regressing innovation orientation on female TMT appointments (Appendix G, Table 1) we note similar patterns to those we find with the TMT change orientation model in our main analysis.

DISCUSSION

We put forth a dynamic model that theorizes time-dependent, within-firm linkages, for how changes in the TMT at one point in time (i.e., female TMT appointments) subsequently shift TMT cognitions, which later cause strategic renewal. Supporting our model, we find that following female TMT appointments, TMT change orientation increases by 10.2%, and TMT risk-taking propensity decreases by 13.5%. Male TMT appointments, in contrast, do not cause TMT cognitions shifts. Further supporting our theorizing, we found that conditions that facilitate the integration of female TMT appointees (i.e., TMT female incumbency and small cohorts of TMT appointees) help amplify the shifts in TMT cognitions that follow female TMT appointments. Qualifying the incumbency findings, it appears that the moderating impact of female incumbency with respect to TMT risk-taking propensity decreases when the

number of incumbent females in the TMT reaches 4 or more. Finally, our statistical results indicate that female TMT appointments indirectly increase R&D via a rise in TMT change orientation, and indirectly lessen M&A via a drop in TMT risk-taking propensity. Taken together, our findings suggest that female TMT appointments contribute to (re)shaping innovation-oriented renewal strategies in multi-national corporations in the span of just a couple of years, and especially so when the TMT includes female incumbents.

Theoretical Contributions

Our study makes three important contributions to the theory and research on women in upper echelons, upper echelons, and strategic renewal. First, it explains *how* female TMT appointments dynamically influence strategic renewal. Indeed, extant research has been unable to pinpoint the mechanisms through which female TMT appointments might affect firm outcomes (Gupta et al., 2020; Roberson et al., 2017), in part because of the reliance on static models and demographics as proxies (rather than antecedents) of TMT-level cognitions (Buyl et al., 2011b; Markóczy, 1997). Remedying these shortcomings, our study offers a unique, dynamic, view of the female TMT – firm outcomes relationship, demonstrating that *shifts in TMT cognition* are a critical TMT-level mechanism linking female (but not male) TMT appointments with strategic change.

Our main findings help to resolve a question that has long frustrated researchers: what changes when a woman enters upper echelons teams? Our study suggests that female (but not male) appointments contribute to shifts in TMT cognitions – specifically TMT risk-taking propensity and TMT change orientation – presumably because of the values that they bring (or are stereotypically expected to bring) to the TMT and because of the dynamics that unfold when groups diversify. Our explanation aligns with research showing that changes in group composition shift group risk-related cognitions (Moscovici & Zavalloni, 1969; Zhu, 2013). In doing so, our study joins others (Engelen et al., 2016; Shin & You, 2017) in showing the

value in going beyond demographics as proxies for, but rather identify their effect on, TMT cognitions and attitudes. Yet, as far as we can tell, we are the first to show the time-dependent, within-firm causal link from female TMT appointment to shifts in TMT cognitions, which, ultimately, produce strategic renewal, answering the call (Hoobler et al., 2018; Jeong & Harrison, 2016; Roberson et al., 2017) to move research on female leaders and firm outcomes from descriptive to explanatory.

The pattern of our additional findings, that female TMT incumbents and smaller cohort sizes of new TMT appointees seem to amplify the shifts in TMT cognitions that follow female TMT appointments, supports our contention that integration into the TMT is central to the difference female TMT appointees are able to make after joining a firm's most upper echelons. As such, our model and findings provide a new, temporal, understanding of critical mass as a mechanism that amplifies women's voice at upper echelons, by showing that the critical mass that is a combination of new female TMT appointees (flow) and TMT female incumbents (stock) of women is most conducive to changing TMT cognitions and, ultimately, to redirecting corporate strategy. Further, our results indicate a pattern of diminishing returns to adding females to a TMT when female TMT incumbency is already high. For example, our threshold interactions show that once a TMT includes four or more women, further appointing women no longer changes the TMT's risk-taking propensity. Note that our threshold interaction estimates rely on small sample sizes because female TMT appointments are relatively rare, especially when TMTs already have female incumbents. As thresholds estimates based on small samples lose precision, they have to be interpreted with caution. Unfortunately, predictions about the rate of progress on gender parity (World Economic Forum, 2019) suggest much time will elapse until diminishing returns can more precisely be tested. Still, our findings align with recent developments in the research on temporal patterns of hiring influence (Wang & Zatzick, 2019), and on the critical role of

TMT integration in moderating the influence of new entrants (Williams et al., 2017; Zhu, 2013; Zhu & Shen, 2016).

Second, we resolve the tension around the seemingly contradictory mechanisms scholars invoke to explain associations between female representation in upper echelons and firm outcomes: (1) female's risk-aversion and diverse teams' more controlled decision making (e.g., Faccio et al., 2016; Homan et al., 2007) or (2) female executives' higher propensity (than males) for status quo disruption and diversity's potential to enhance a team's receptivity to new ideas (e.g., Furst & Reeves, 2008; Wiersema & Bantel, 1992). Recent insights about women's career paths and experiences on the way to the C-suite allowed us to integrate both explanations in one model and to offer a more comprehensive picture of how the entry of female executives into upper corporate echelons contributes to shift TMT cognitions and, ultimately, to change a firm's knowledge-based renewal strategies.

Third, our model advances UET (Carpenter et al., 2004; Hambrick, 2007) and research on strategic renewal. UET scholars have previously linked new TMT appointments with strategic change (Barker III et al., 2001; Williams et al., 2017), but have rarely assessed how these changes unfold over time (Kunisch et al., 2017; Langley et al., 2013). Similarly, the role of upper echelons in shaping strategic renewal and firm dynamic capabilities has long been recognized but seldom studied systematically (Augier & Teece, 2009; Schmitt et al., 2018). Recently, after reviewing the literature, Schmitt et al. (2018) urged scholars to explore the temporal dynamics of strategic renewal because it manifests in path-dependent trajectories of renewal activities. This implies that much strategic renewal is of an incremental nature, whereas most past work on renewal has focused on discontinuous strategic transformations (Agarwal & Helfat, 2009). To understand the process and content of incremental renewal, longer time horizons are needed to obtain "a more fine-grained understanding of 'when', 'how' and 'why' organizations adopt specific strategic renewal

behaviors" (Schmitt et al., 2018: 93). Our study contributes to this understanding as it shows that changes in a TMT's gender composition alter the nature of a firm's knowledge-based renewal strategy from buying to building knowledge capabilities. By linking UET to strategic renewal in a dynamic way, identifying factors and mechanisms that trigger change in a firm's trajectory (Schmitt et al., 2018), our study advances both bodies of work (Buyl et al., 2011b; Hambrick, 2007; Kunisch et al., 2017; Schmitt et al., 2018).

Future Research Directions and Implications for Practice

Our study also suggests ways to reinvigorate and redirect research on women in upper echelons and UET. First, our theory and findings open the door for future studies to identify other dynamic models linking female entry into upper echelons with firm decisions, via changes in those upper echelon groups' cognitions. For example, female TMT appointments may influence TMT moral sensitivities, which in turn could help explain inter-firm, as well as intra-firm variance over time, in corporate social responsibility, given documented gender differences in care and justice ethical orientations (Jaffee & Hyde, 2000). This would certainly be consistent with the body of work linking female board representation and corporate social responsibility (Byron & Post, 2016). Alternatively, future research could explore further how the affective tone on TMTs may shift, in conversation, to shape strategic decisions (Huy, 2012; Liu & Maitlis, 2014) after female appointments.

Second, and because our findings do not determine *how* female TMT appointments bring about TMT cognitions, our study should motivate new research on the processes through which these shifts occur. For example, it is conceivable that stereotypical ascriptions of risk orientations to genders (Eckel & Grossman, 2008), more so than actual gender differences in risk-aversion, trigger changes in group thinking (Leavitt, Zhu, & Aquino, 2016). Alternatively, the added diversity that female appointees bring to a TMT may free those men on the team with more risk-aversion to speak up, as they may feel less isolated or

threatened in doing so on a more diverse team (Bowen & Blackmon, 2003).

Finally, our study suggests ways to strengthen and advance research bridging UET and strategic renewal. To date, the empirical approach to this question has, with some exceptions (e.g., Cho & Hambrick, 2006; Porac, Thomas, & Baden-Fuller, 1989), been static and reliant on TMT demographics as proxies for TMT cognition (Barkema & Shvyrkov, 2007; Hambrick, Cho, & Chen, 1996). Empirically showing, as we do, how and when TMT cognitions shift following TMT appointments, and then cause strategic renewal, is challenging, in part because of the hurdles in measuring TMT cognitions and their change over long periods of time and for many firms. Collecting psychological and attitudinal TMT- or board-level data to develop such dynamic models requires computerized coding techniques that can measure constructs using longitudinal archival data. Luckily, several such constructs have associated word dictionaries for such coding (Crilly, Hansen, & Zollo, 2016; Gamache, McNamara, Mannor, & Johnson, 2015; Nadkarni & Chen, 2014).

Our study has important practical implications. Our model assumes that female appointees bring (or are presumed to bring) different cognitions, social and human capital and/or set off team diversity dynamics. If our assumptions are correct, CEOs and corporate boards may want to think carefully about how the qualities and demographics of executives appointed to their TMT may shape the TMT's approach to strategic decision-making. Further, our study provides new evidence about the limits of appointing women as tokens, without attending to their integration into upper echelons teams. CEOs and boards counting on a female appointees to prompt new ways of thinking on their TMT or in their boardrooms may find their effort to be more successful if they commit to diversifying their TMT more and are more receptive to new female TMT appointees. Further, female executives invited to join an all-male TMT may want to ascertain the CEO's beliefs about female executives, because teams are more likely to incorporate female tokens' input into real-time strategic

decisions when the team leader's gender beliefs are more positive (Farh et al., 2020).

Finally, our finding that female TMT appointments only bring about strategic renewal when they are better integrated into the TMT, and that this occurs through both a reduction in TMT risk-taking propensity and an increase in TMT change orientation, counter-balances the hyped-up idea that women are "pixie-dust" to be sprinkled into upper echelons, or "mistresses of the Universe" (Kristof, 2009) who, had they only been "Lehman Sisters" may have averted the 2009 global financial crisis. Such narratives not only distort and simplify complex relationships (Eagly, 2016; Post et al., forthcoming); they may also contribute to keeping women out of high-stakes decision jobs, steering them into precarious roles that involve cleaning up after failed organizational gambles (Ryan et al., 2016).

Limitations

Our study is not without limitations. First, while our model offers two non-exclusive explanations: (i) that female executives bring (or are assumed to bring) different values and life experiences to the TMT, which might directly shape TMT cognitions; (ii) that TMT cognitions change indirectly as a function of team processes resulting from exposure to more diversity, our data and analyses cannot disentangle both explanations for *why* TMT cognitions shift following female TMT appointments.

In addition, we focused here on one aspect of TMT demography, in which new TMT appointees might differ from each other (and from incumbents): their gender. Studies show that other TMT appointee characteristics also shape firm strategy (e.g., Kish-Gephart & Campbell, 2015; Williams et al., 2017), although these studies do not isolate *how* TMT appointments affect strategic decisions. Extending our line of reasoning to other dimensions along which new TMT appointees differ from incumbent executives (e.g., race; age; national origin; social class) may help to ascertain the generalizability of our proposed mechanism linking TMT appointments to changes in firms' innovation strategies.

Further, we crafted our model to introduce a temporal, within-firm causal mechanism linking female TMT appointments with strategic renewal, via shifts in TMT cognitions. While we also examined how women's integration into the TMT moderates these relationships, future research could further develop the moderators in this temporal causal chain – for example drawing on other work on such moderators as managerial discretion (Jeong & Harrison, 2016), socio-cultural context (Post & Byron, 2015), and demographic faultlines between male and female TMT sub-groups (Georgakakis & Buyl, 2020).

Finally, our study considers letters to the shareholders as a reflection of TMT cognitions, because letters are the "product of a collective and consensual process at the apex of organization" (Levy, 2005: 804). However, LTS also reflect TMT impression management efforts (Patelli & Pedrini, 2014), which may be gendered (Bolino, Long, & Turnley, 2016; Parhankangas & Ehrlich, 2014). Parceling out the extent to which LTS reveal TMT cognitions versus impression management strategies was beyond the scope of our study, but perhaps worthy of investigation. Given our finding that TMT risk-taking propensity and TMT change orientation influence R&D and M&A, we suspect that the letters would reveal more about the cognitions of the TMT than just impression management.

CONCLUSION

Despite numerous studies linking female TMT representation to firm outcomes (Hoobler et al., 2018; Jeong & Harrison, 2016), we know little about what happens to these elite, male-dominated groups, when female executives break into them. Our focus on female TMT appointments as catalysts that cause shifts in TMT cognitions, which, in turn, bring about strategic change in the buying and building of firm resources, is a novel effort at redirecting research on women at upper echelons to examine time-dependent, within-firm mechanisms linking women in upper echelons and firm outcomes. We hope our study spurs more inquiry into the role of TMT appointments, TMT cognition shifts, and strategic change and renewal.

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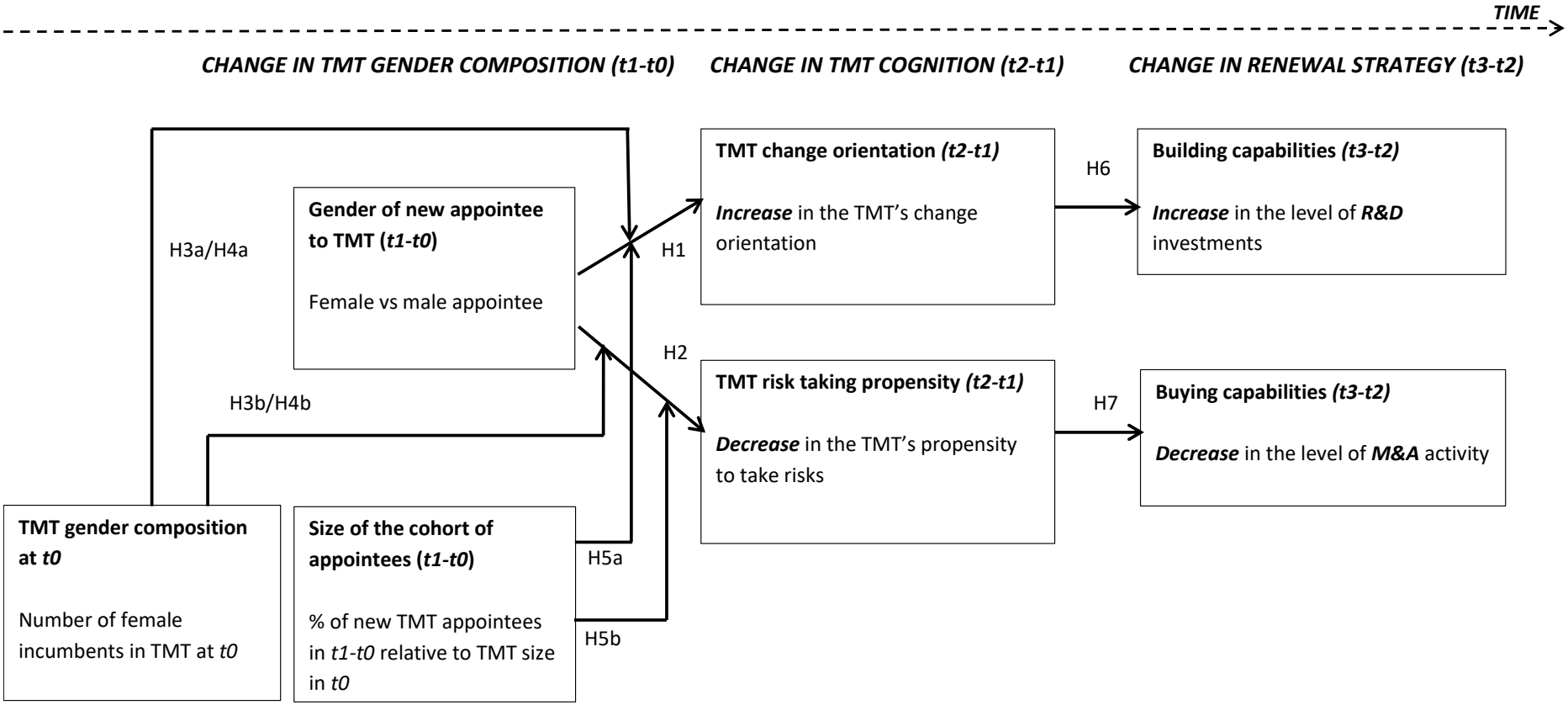
FIGURE 1

A dynamic model of within-firm strategic renewal following female TMT appointments [9]



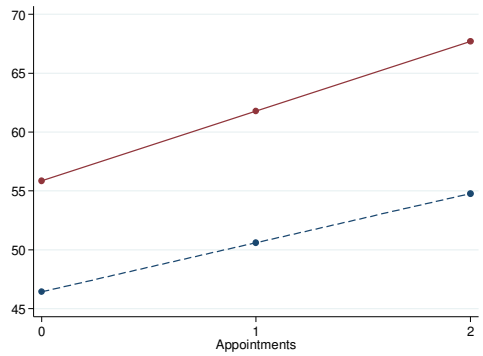
[9] For the sake of parsimony, we only indicate hypothesized relationships, although we also acknowledge that risk-taking propensity might affect R&D investments and that TMT change orientation might affect M&A activity, and control for these possibilities in our analyses.

FIGURE 2

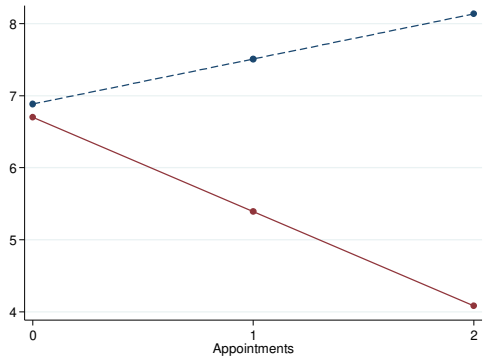
Marginal effects of appointing women to the TMT

Panel 1. Marginal effects of TMT appointments in TMTs with and without female incumbency

A. TMT change orientation



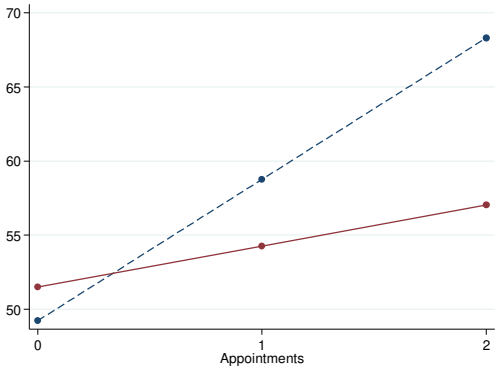
B. TMT risk-taking propensity



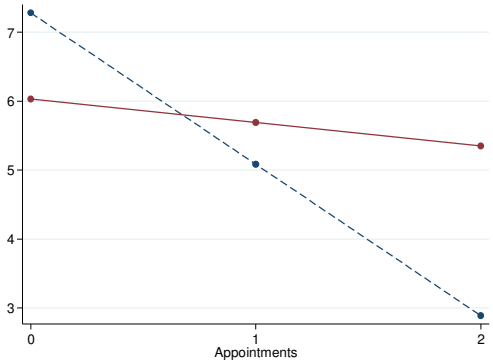
NB: Solid lines represent TMTs with female incumbents and dotted lines represent TMTs without female incumbents. On the vertical axis is the predicted count of TMT change orientation (Panel A) and TMT risk-taking propensity (Panel B) words per document of 10K words.

Panel 2. Marginal effects of TMT appointments in TMTs with a small & large incoming cohort

A. TMT change orientation



B. TMT risk-taking propensity



NB: Dotted lines represent small cohorts of new TMTs appointees and solid lines represent large cohorts of new TMT appointees. On the vertical axis is the predicted count of TMT change orientation (Panel A) and TMT risk-taking propensity (Panel B) words per document of 10K words.

TABLE 1

Descriptive statistics and pairwise correlations

		Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.	Δ TMT change orientation	0.01	0.36																			
2.	TMT change orientation. $_{t-1}$	0.50	0.34	-0.50																		
3.	Δ TMT risk-taking propensity	0.00	0.12	0.03	-0.03																	
4.	TMT risk-taking propensity. $_{t-1}$	0.07	0.10	-0.02	0.00	-0.59																
5.	R&D growth†‡	0.22	0.26	0.02	-0.06	-0.01	-0.04															
6.	Δ M&A†	0.10	2.58	0.04	-0.02	0.05	-0.04	0.01														
7.	Female TMT appointments	0.14	0.46	0.03	0.10	-0.03	-0.02	-0.02	0.02													
8.	Male TMT appointments	1.31	1.91	-0.02	0.12	0.00	-0.05	0.03	0.04	0.33												
9.	Δ CEO tenure	-0.09	2.07	-0.02	0.02	0.00	0.04	0.00	0.04	0.02	0.05											
10.	Δ CEO age	0.05	4.18	0.00	-0.01	-0.02	0.03	-0.01	-0.02	0.01	-0.03	0.17										
11.	Δ TMT social stratification†	0.02	0.40	0.02	-0.06	0.01	-0.03	0.09	0.01	-0.01	-0.01	0.00	0.06									
12.	Δ TMT national. diversity†	0.01	0.10	0.01	0.03	-0.03	0.00	0.05	0.01	-0.01	0.02	0.02	0.03	0.06								
13.	Δ TMT size†	0.26	2.51	-0.01	-0.01	-0.01	-0.02	0.09	0.04	0.03	0.16	0.02	0.00	0.22	0.08							
14.	Δ Female board represent.	0.09	0.49	0.01	0.00	-0.03	0.05	-0.01	0.01	0.00	0.03	0.00	-0.02	-0.02	-0.01	0.01						
15.	Δ Firm size†‡	0.02	0.30	-0.01	0.00	0.00	-0.04	0.06	0.01	-0.03	0.00	-0.03	0.02	0.02	0.04	0.06	-0.02					
16.	Δ Prod diversity sales†	0.01	0.11	0.00	0.02	-0.03	0.01	0.01	0.05	-0.01	0.01	0.01	0.02	-0.02	0.01	0.02	0.04	0.09				
17.	Δ R&D intensity	0.00	0.03	-0.04	0.02	-0.01	0.01	0.02	0.00	-0.03	0.02	0.00	-0.01	0.00	0.00	0.03	-0.02	0.02	-0.01			
18.	Δ Women in management (country), in %	0.28	1.35	0.03	0.00	0.03	-0.02	0.12	-0.08	-0.02	0.03	0.05	0.00	0.02	0.02	0.01	-0.01	0.00	-0.01	0.01		
19.	Δ Gender gap index WEF	0.20	0.93	-0.02	0.03	0.00	0.02	-0.16	0.03	0.02	-0.04	-0.03	0.00	0.00	-0.02	-0.09	0.00	0.00	0.00	-0.01	-0.06	
20.	Word count LTS	18.93	20.15	-0.02	-0.07	0.01	0.04	0.00	0.03	0.04	0.03	-0.01	0.01	-0.02	0.02	-0.03	-0.01	0.01	0.04	0.00	-0.08	-0.04

Note n=1,911 Correlations greater than |.045| are significant at p<.05. Word count LTS is in 100

† The underlying variable was modeled in Boone et al (2019)

‡ The underlying variable was modeled in Belderbos et al (2018)

TABLE 2

Female appointments, and shifts in TMT change orientation and in TMT risk-taking propensity

	(1)	(2)	(3)	(4)
	Δ CO	Δ RTP	Δ CO	Δ RTP
Δ CEO tenure	-0.003	0.001	-0.003	0.002
	(0.003)	(0.001)	(0.003)	(0.001)
Δ CEO age	0.000	-0.000	0.000	-0.000
	(0.002)	(0.001)	(0.002)	(0.001)
Δ TMT social stratification	-0.005	0.000	-0.005	0.000
	(0.018)	(0.005)	(0.018)	(0.005)
Δ TMT nationality diversity	0.101	-0.037	0.106	-0.037
	(0.058)	(0.019)	(0.057)	(0.019)
Δ TMT size	-0.003	-0.001	-0.003	-0.001
	(0.003)	(0.001)	(0.003)	(0.001)
Δ Female board representation	0.007	-0.002	0.008	-0.002
	(0.014)	(0.005)	(0.014)	(0.005)
Δ Firm size	-0.007	-0.005	-0.005	-0.006
	(0.016)	(0.005)	(0.016)	(0.005)
Δ Prod diversity sales	0.015	-0.021	0.016	-0.021
	(0.069)	(0.018)	(0.069)	(0.018)
Δ R&D intensity	-0.352*	-0.007	-0.334*	-0.009
	(0.171)	(0.038)	(0.157)	(0.038)
Δ Women in management (country)	0.006	0.001	0.007	0.001
	(0.005)	(0.002)	(0.005)	(0.002)
Δ Gender gap index	-0.004	0.001	-0.004	0.001
	(0.007)	(0.002)	(0.007)	(0.002)
LTS word count	-0.001***	0.000	-0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
TMT size	0.002*	0.000	0.001	0.001*
	(0.001)	(0.000)	(0.001)	(0.000)
TMT change orientation in t-1	-0.575***		-0.577***	
	(0.026)		(0.026)	
TMT risk-taking propensity t-1		-0.736***		-0.737***
		(0.031)		(0.031)
Male appointments TMT			-0.003	-0.001
			(0.005)	(0.001)
Female appointments TMT			0.051*	-0.009*
			(0.021)	(0.004)
No of firms	163	163	163	163
No of observations	1911	1911	1911	1911
R2	.280	.366	.284	.368

Note: Δ RTP = change in TMT risk-taking propensity. Δ CO = change in TMT change orientation. All models are estimated with OLS and include industry dummies and a constant; their effects are available upon request. * p<0.05; ** p<0.01; *** p<0.01, two-tailed tests (robust standard errors in parentheses)

TABLE 3. Female appointments, TMT change orientation, TMT risk-taking propensity, and TMT female incumbency

	(5)	(6)	(7)	(8)
	Δ CO	Δ CO	Δ RTP	Δ RTP
	Incumbency=0	Incumbency>0	Incumbency=0	Incumbency>0
Δ CEO tenure	-0.004	0.001	0.002	0.002
	(0.003)	(0.008)	(0.001)	(0.002)
Δ CEO age	0.001	-0.001	0.001	-0.001
	(0.002)	(0.004)	(0.001)	(0.001)
Δ TMT social stratification	-0.002	-0.013	0.005	-0.002
	(0.024)	(0.028)	(0.008)	(0.005)
Δ TMT nationality diversity	0.123*	0.049	-0.031	-0.062
	(0.062)	(0.162)	(0.023)	(0.032)
Δ TMT size	-0.008*	-0.000	-0.002	-0.001
	(0.004)	(0.004)	(0.001)	(0.001)
Δ Female board representation	0.011	0.002	0.000	-0.003
	(0.021)	(0.019)	(0.009)	(0.006)
Δ Firm size	-0.010	0.001	-0.006	-0.004
	(0.036)	(0.013)	(0.013)	(0.005)
Δ Prod diversity sales	0.032	0.006	-0.022	-0.018
	(0.087)	(0.115)	(0.024)	(0.028)
Δ R&D intensity	-0.549	-0.340*	-0.348	0.019
	(0.461)	(0.166)	(0.244)	(0.031)
Δ Women in management (country)	0.008	0.001	0.000	0.005
	(0.005)	(0.012)	(0.002)	(0.004)
Δ Gender gap index	-0.009	0.001	0.003	-0.004
	(0.008)	(0.012)	(0.004)	(0.003)
LTS word count	-0.001*	-0.003***	0.000	0.001**
	(0.000)	(0.001)	(0.000)	(0.000)
TMT size	0.002	0.002	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.000)
TMT change orientation in t-1	-0.582***	-0.597***		
	(0.032)	(0.042)		
TMT risk-taking propensity t-1			-0.725***	-0.773***
			(0.042)	(0.040)
Male appointments TMT	0.004	-0.009	-0.000	-0.002
	(0.005)	(0.008)	(0.002)	(0.002)
Female appointments TMT	0.042	0.059*	0.006	-0.013**
	(0.025)	(0.028)	(0.011)	(0.004)
No of firms	132	95	132	95
No of observations	1188	723	1188	723
R2	.293	.303	.358	.413

Note: Δ RTP = change in TMT risk-taking propensity. Δ CO = change in TMT change orientation. All models are estimated with OLS and include industry dummies and a constant; their effects are available upon request. * p<0.05; ** p<0.01; *** p<0.01, two-tailed tests (robust standard errors in parentheses)

TABLE 4. Female appointments, TMT change orientation, TMT risk-taking propensity, and the thresholds effects of TMT female incumbency in moderating TMT appointment effects.

	(9)	(10)
	Δ CO	Δ RTP
TMT receptivity to change in t-1	-0.576***	
	(0.026)	
TMT willingness to take risks t-1		-0.739***
		(0.031)
Threshold effects		
Male appointments TMT # TMT Female Incumbents = 0	-0.000	-0.001
	(0.005)	(0.002)
Male appointments TMT # TMT Female Incumbents = 1	-0.014	-0.002
	(0.009)	(0.002)
Male appointments TMT # TMT Female Incumbents = 2	0.009	0.006
	(0.014)	(0.004)
Male appointments TMT # TMT Female Incumbents = 3	0.005	-0.005***
	(0.017)	(0.001)
Male appointments TMT # TMT Female Incumbents >= 4	-0.011	-0.003
	(0.011)	(0.002)
Female appointments TMT # TMT Female Incumbents = 0 (β_0)	0.031	0.007
	(0.025)	(0.011)
Female appointments TMT # TMT Female Incumbents = 1 (β_1)	0.136*	-0.020*
	(0.062)	(0.010)
Female appointments TMT # TMT Female Incumbents = 2 (β_2)	0.029	-0.029**
	(0.041)	(0.010)
Female appointments TMT # TMT Female Incumbents = 3 (β_3)	0.049	-0.019***
	(0.058)	(0.004)
Female appointments TMT # TMT Female Incumbents >= 4 (β_4)	0.053	-0.002
	(0.045)	(0.006)
No of firms	163	163
No of obs.	1911	1911
R2	.287	.372

Note: Δ RTP = change in TMT risk-taking propensity. Δ CO = change in TMT change orientation. All models are estimated with OLS and include industry dummies and a constant as well as same control variables as in the base specification (see Table 2 for a complete list). Their effects are very similar to those reported in Table 2 and are available upon request. * p<0.05; ** p<0.01; *** p<0.01, two-tailed tests (robust standard errors in parentheses).

TABLE 5. Female appointments, TMT change orientation, TMT risk-taking propensity, and size of the cohort of new TMT appointees

	(11)	(12)	(13)	(14)
	Δ CO	Δ CO	Δ RTP	Δ RTP
	Small cohort	Large cohort	Small cohort	Large cohort
Δ CEO tenure	-0.001	-0.003	0.000	0.003*
	(0.005)	(0.004)	(0.001)	(0.001)
Δ CEO age	-0.002	0.001	0.000	-0.000
	(0.003)	(0.002)	(0.001)	(0.001)
Δ TMT social stratification	0.010	-0.032	0.006	-0.010
	(0.023)	(0.030)	(0.006)	(0.008)
Δ TMT nationality diversity	0.112	0.094	-0.038	-0.033
	(0.096)	(0.072)	(0.030)	(0.025)
Δ TMT size	-0.001	-0.007	-0.002	0.001
	(0.004)	(0.004)	(0.001)	(0.001)
Δ Female board representation	0.011	-0.002	0.000	-0.009
	(0.017)	(0.026)	(0.007)	(0.006)
Δ Firm size	-0.015	0.016	-0.010	-0.000
	(0.025)	(0.035)	(0.006)	(0.007)
Δ Prod diversity sales	-0.017	0.065	0.001	-0.047
	(0.080)	(0.126)	(0.025)	(0.026)
Δ R&D intensity	-0.285*	-0.798	0.008	-0.208
	(0.140)	(0.611)	(0.039)	(0.148)
Δ Women in management (country)	0.003	0.010	0.003	-0.000
	(0.006)	(0.007)	(0.002)	(0.003)
Δ Gender gap index	-0.004	-0.001	-0.002	0.004
	(0.009)	(0.010)	(0.003)	(0.004)
LTS Word count	-0.001**	-0.002**	0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)
TMT size	0.000	0.004*	0.000	0.000
	(0.001)	(0.002)	(0.000)	(0.000)
TMT change orientation in t-1	-0.548***	-0.628***		
	(0.035)	(0.038)		
TMT risk-taking propensity t-1			-0.707***	-0.788***
			(0.039)	(0.048)
Male appointments TMT	-0.008	-0.007	0.002	-0.000
	(0.016)	(0.007)	(0.004)	(0.002)
Female appointments TMT	0.095	0.028	-0.022**	-0.003
	(0.049)	(0.024)	(0.007)	(0.005)
No of firms	162	157	162	157
No of observations	1177	734	1177	734
R2	.260	.344	.364	.409

Note: Δ RTP = change in TMT risk-taking propensity. Δ CO = change in TMT change orientation. Mean value is used to distinguish large and small cohorts. All models are estimated with OLS and include industry dummies and a constant; their effects are available upon request. * p<0.05; ** p<0.01; *** p<0.01, two-tailed tests (robust standard errors in parentheses)

TABLE 6

TMT change orientation, TMT risk-taking propensity, and M&A and R&D

	(15)	(16)	(17)	(18)	(19)	(20)
	Δ R&D	Δ R&D	Δ R&D	Δ M&A	Δ M&A	Δ M&A
Δ CEO tenure	-0.001	-0.001	-0.001	0.051*	0.049*	0.051*
	(0.002)	(0.002)	(0.002)	(0.022)	(0.022)	(0.022)
Δ CEO age	-0.001	-0.001	-0.001	-0.025	-0.024	-0.024
	(0.001)	(0.001)	(0.001)	(0.015)	(0.015)	(0.015)
Δ TMT social stratification	0.050	0.050	0.049	0.023	0.023	0.016
	(0.045)	(0.045)	(0.045)	(0.166)	(0.167)	(0.166)
Δ TMT nationality diversity	0.073	0.077	0.076	-0.052	0.010	0.000
	(0.047)	(0.047)	(0.047)	(0.369)	(0.376)	(0.375)
Δ TMT size	0.005*	0.005*	0.005*	0.025	0.024	0.025
	(0.003)	(0.002)	(0.003)	(0.042)	(0.042)	(0.042)
Δ Female board representation	-0.005	-0.004	-0.005	0.011	0.030	0.023
	(0.008)	(0.008)	(0.008)	(0.116)	(0.116)	(0.116)
Δ Firm size	0.051	0.050	0.051	-0.052	-0.060	-0.055
	(0.031)	(0.030)	(0.030)	(0.236)	(0.230)	(0.234)
Δ Prod diversity sales	0.022	0.024	0.024	1.110	1.153	1.154
	(0.043)	(0.043)	(0.043)	(0.838)	(0.841)	(0.841)
Δ R&D intensity	0.138	0.114	0.141	0.657	0.506	0.710
	(0.179)	(0.171)	(0.180)	(1.406)	(1.399)	(1.407)
Δ Women in management (country)	0.020	0.020	0.020	-0.167*	-0.168*	-0.171*
	(0.017)	(0.017)	(0.016)	(0.082)	(0.082)	(0.082)
Δ Gender gap index	-0.049	-0.049	-0.048	-0.001	-0.003	0.000
	(0.045)	(0.045)	(0.045)	(0.099)	(0.099)	(0.099)
Δ TMT change orientation	0.059*		0.059*	0.464		0.457
	(0.029)		(0.029)	(0.306)		(0.306)
Δ TMT risk-taking propensity		0.076	0.074		1.419*	1.404*
		(0.046)	(0.046)		(0.592)	(0.592)
TMT size	-0.001	-0.001	-0.001	0.009	0.009	0.009
	(0.001)	(0.001)	(0.001)	(0.015)	(0.015)	(0.015)
Male appointments TMT	0.006	0.005	0.006	-0.011	-0.015	-0.011
	(0.004)	(0.004)	(0.004)	(0.047)	(0.047)	(0.047)
Female appointments TMT	-0.013	-0.010	-0.012	-0.045	-0.017	-0.032
	(0.007)	(0.007)	(0.007)	(0.181)	(0.181)	(0.180)
No of firms	163	163	163	163	163	163
No of observations	1911	1911	1911	1911	1911	1911
R2	.09	.09	.09	.14	.14	.14

Note: Δ TMT risk-taking propensity and Δ TMT change orientation are predicted variables from models (3) and (4). All models are estimated with OLS and include industry dummies; their effects are available upon request. * p<0.05; ** p<0.01; *** p<0.01, two-tailed tests (bootstrapped standard errors in parentheses)

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