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TOO MUCH ON THE PLATE? HOW EXECUTIVE JOB DEMANDS HARM FIRM INNOVATION AND REDUCE SHARE OF EXPLORATORY INNOVATIONS

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Building on psychological research on job demands and executive job demands theory, we explain why executive job demands negatively influence a firm's overall innovation and shift the balance of innovative activities toward a larger share of exploitative innovations at the expense of exploratory innovations, leading to a smaller share of innovations that are exploratory. In addition, we explain how variety in executives' gender, age, and tenure and an innovative climate weaken the negative effects of job demands on both overall innovation and the share of exploratory innovations. Our theory suggests that a controlling climate and employees' education weaken the negative effect of job demands on overall innovation but exacerbate the negative effect of job demands on the share of exploratory innovations. Using surveys collected on-site from 243 Chinese firms, we find support for five of our 10 hypotheses and marginal support for three additional hypotheses but no support for the two moderating effects of innovative climate. This study shifts innovation scholars' attention away from executive cognition and characteristics to their job environment attributes. It also develops executive job demands theory by examining its boundaries and applicability to the domain of innovation management.

An important typology of innovation has distinguished between exploratory and exploitative innovations (March, 1991). While exploratory innovations generate new knowledge and develop new products for emerging customers, exploitative innovations build on existing knowledge and extend current products for existing customers (Levinthal & March, 1993). A large body of literature has further emphasized that firms not only need to achieve success in overall innovation but also ensure a healthy share of exploratory innovations such that exploitation does not crowd out exploration (Benner & Tushman, 2002; Gibson & Birkinshaw, 2004; Heavey & Simsek, 2017; Tushman & O'Reilly, 1996; Uotila, Maula, Keil, & Zahra, 2009).

Because top executives have major impacts on innovation outcomes, there has been an increasing emphasis on how their attributes and cognition influence both overall innovation (Barker & Mueller, 2002; Ding, 2011; Eggers & Kaplan, 2009; Gavetti & Levinthal, 2000; Nadkarni & Chen, 2014; Qian, Cao, & Takeuchi, 2013; Wu, Levitas, & Priem, 2005) and share of exploratory innovations (Cao, Simsek, & Zhang, 2010; Lubatkin, Simsek, Ling, & Veiga, 2006). Yet extant research has focused almost entirely on top executives' attributes and cognition, paying little attention to the potential influence of their job environment on innovation outcomes. Research in social psychology (e.g., Ross & Nisbett, 2011) and management

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(e.g., Simsek, Heavey, & Fox, 2018; Westphal & Zajac, 2013) has highlighted that both personal and situational factors can substantially influence the behavior and decision-making of top executives. Accordingly, without a rich understanding of the relationship between executives' job environment and innovation, an entire set of situational factors that can influence firm innovation are neglected, which risks omitting important variables in examining the determinants of innovation outcomes.

A fundamental feature of top executives' objective job environment is the job's demands. Executive job demands are all physical, psychological, social, and organizational aspects of the job that require sustained physical or psychological effort from top executives (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; Hambrick, Finkelstein, & Mooney, 2005; Karasek, 1979). Although Hambrick (2007) suggested that executive job demand is one of the most important constructs in upper echelons theory, research has not examined how it can influence firm innovation, which is a fundamental issue in management. Without studying the impacts of executive job demands on innovation outcomes, strategic leadership scholars would not fully understand the relevance of executive job demands to these key issues in strategy research. In addition, no studies have examined the boundary conditions of executive job demands theory (Hambrick et al., 2005). It is thus also important to incorporate the insights from psychological research to further develop executive job demands theory by examining its boundary conditions.

Building on executive job demands theory (Hambrick et al., 2005), we explain why job demands on members of the top management team (TMT) reduce their tendency to process information as rational decision makers, negatively influencing overall firm innovation. In addition, we suggest that executive job demands shift the balance of innovative activities toward an increased share of exploitative innovations at the expense of exploratory innovations, leading to a reduced share of innovations that are exploratory. Because research on job demands has emphasized that their effect is often contingent on factors that (a) reflect people's cognitive capabilities, (b) reduce demand on their cognitive resources, and (c) compensate for the lack of such resources (Demerouti et al., 2001; Schaufeli & Bakker, 2004), we further suggest that the effect of executive job demands is contingent on (a) executives' cognitive capabilities (by virtue of TMT variety in gender, age, and tenure); (b) a controlling climate that reduces demand on executives' cognitive resources; and (c) organizational resources (i.e., an innovative climate and employees' education) that compensate for their lack of cognitive resources. Using surveys collected on-site from 243 Chinese firms, we find support for five of our 10 hypotheses and marginal support for three additional hypotheses, but no support for the two moderating effects of innovative climate.

This study makes important contributions to research on innovation. Although many studies have adopted a behavioral approach and investigated how top executives' cognition and individual attributes influence innovation, little theoretical or empirical work has examined how the characteristics of top executives' job environment influence innovation activities. In explaining how job demands, as a central attribute of top executives' objective job environment, negatively influence a firm's overall innovation and share of exploratory innovations, our study advances a theoretically important and novel perspective to understand the determinants of firm innovation.

Our study also significantly advances strategic leadership research on job demands. Although the construct of executive job demands has long been regarded as fundamental in upper echelons theory (Hambrick, 2007; Hambrick et al., 2005), theoretical work has not examined its boundaries or its applicability to firm innovation. In explaining how TMTs' cognitive capabilities, a controlling climate that reduces demands on executives' cognitive resources, and organizational resources that compensate for their lack of cognitive resources may moderate the effect of executive job demands on firm innovation, this study enriches our understanding of the boundary conditions of executive job demands theory and extends its applicability to a key domain of research in management. Moreover, research on executive job demands theory has not yet provided sufficient evidence of its validity. In showing how executive job demands negatively influence overall innovation and share of exploratory innovations, our study offers the first piece of direct evidence of the validity of an important theory in strategic leadership research.

THEORY AND HYPOTHESES

Executive Job Demands

In developing the theory of executive job demands, Hambrick et al. (2005: 473) explained that "we consider executive job demands to be a variation of the broader, well-established construct of job demands (e.g., Janssen, 2001; Karasek, 1979)" and

referred to executive job demands as "job demands at the executive level." As a widely studied construct in the fields of psychology and organizational behavior, job demands include all aspects of the job that require continuous physical or psychological effort. Prevailing perspectives on job demands treat them as a characteristic of jobs, reflecting a key feature of the objective job environment (e.g., Demerouti et al., 2001; Janssen, 2001; Karasek, 1979). Following prior research, we thus define executive job demands as all aspects of top executives' jobs that require continuous physical and psychological effort and consider them a fundamental feature of top executives' objective job environment. This definition allows for a clear distinction to be made between the effect of the job environment and the effect of individual differences on experienced demands. Following existing research, we also suggest that executive job demands include both quantitative and qualitative dimensions (Edwards, 1996; Janssen, 2001; Karasek, 1979). The quantitative aspect of executive job demands is primarily associated with workload, which is reflected in the amount of work and time pressures at work; the qualitative aspect of executive job demands concerns organizational politics, role ambiguity, and role conflict at work (Demerouti et al., 2001).

Although there is abundant evidence to show that job demands significantly influence workers' behavior, well-being, and performance outcomes (Schaufeli & Bakker, 2004), only a handful of studies since Hambrick et al. (2005) have provided indirect evidence on the effect of executive job demands on strategic outcomes. Two studies assumed that CEOs are especially likely to experience high job demands in special contexts and applied the job demands logic in explaining hypothesized relationships. Specifically, Chen (2015) suggested that new CEOs appointed to underperforming firms tend to face high job demands and found that these new CEOs receive higher compensation than others. Wang and Yang (2015) similarly suggested that executive job demands are especially high for new CEOs appointed to highly diversified firms.

There is evidence that job demands tend to be relatively high on top executives, making them especially prone to the negative influences of these demands. Top executives typically work under ambiguous role expectations and need to manage conflicting demands from various stakeholders (Finkelstein, Hambrick, & Cannella, 2009; Hambrick et al., 2005; Henderson & Fredrickson, 1996). In addition, many top executives work excessively long hours. For example, GE's Jeff Immelt has been known to work 100 hours per week on a regular basis, which is twice as much as the average worker. Many top executives have also experienced severe negative consequences, such as anxiety, burnout, and depression (Mannor, Wowak, Bartkus, & Gomez-Mejia, 2016).

Although executive job demands are generally high, different job environments place different levels of job demands on executives. Because research has provided considerable evidence to show that top executives represent a distinctive group of individuals, such that the findings from studies on the average employee often do not apply to them (Finkelstein et al., 2009; Norburn, 1989), it is necessary to discuss the antecedents and consequences of executive job demands.

Research on top executives has shown that their job environments differ from those of other employees, making many known antecedents of employee job demands irrelevant to top executives. For example, studies of job demands on employees have typically focused on intensive labor, undesirable physical environments at work, and supervisors' leadership (Demerouti et al., 2001). Clearly, these factors are often not major determinants of executive job demands. In their conceptual work, Hambrick et al. (2005) discussed how task challenges, performance challenges, and executive aspirations are major determinants of job demands on top executives.

Task challenges reflect conditions in the job environment that make it difficult for top executives to achieve a certain level of performance (Hambrick et al., 2005). Typical task challenges arise from managing a business in a hostile environment in which top executives face considerable pressures from key external constituents such as suppliers, buyers, and competitors. Other important task challenges come from operating in a dynamic environment where top executives need to constantly process relatively large amounts of changing information and make decisions under uncertainty. *Performance challenges* are high when top executives cannot meet performance expectations. *Aspirations* (the drive to perform) are influenced by personality factors; in particular, CEOs who have a stronger need for achievement (Miller & Dröge, 1986) are expected to have higher aspirations and place more demands on themselves (Hambrick et al., 2005). Because other members of the TMT work under the CEO's leadership, when a CEO has a stronger need for achievement, job demands on TMT members can also be higher.

Extant research has also highlighted the important consequences of executive job demands on top executives' attention, decision-making, and organizational outcomes. Hambrick et al. (2005) explained that executive job demands can fundamentally influence the extent of top executives' rational decision-making. Although top executives are motivated to make rational decisions, their limited cognitive resources do not allow them to pay attention to all aspects of the task environment or process information in an entirely rational fashion (Finkelstein et al., 2009; Hambrick & Mason, 1984). The greater the job demands on top executives, the more they will have to rely on heuristics, existing inclinations, and past experiences in searching for information, processing information, and making decisions. Thus, executive job demands are theorized to generally strengthen the effect of top executives' characteristics on their strategic choices.

In addition, executive job demands can prompt top executives to imitate the prevailing practices of other organizations to save their cognitive resources based on the assumption that these practices generally reduce uncertainty and provide legitimacy (Hambrick et al., 2005). Moreover, new CEOs' job demands tend to be positively associated with both their compensation (Chen, 2015) and their likelihood of dismissal (Wang & Yang, 2015). Hambrick et al. (2005) further suggested that top executives under high job demands may impose high job demands on subordinates. Executives under low job demands may also seek to create an impression that they are under high job demands; conversely, those under high job demands may focus on conveying confidence and calm. No conceptual or empirical studies, however, have examined the potential effect of executive job demands on innovation outcomes. In addition, despite increasing evidence that the effect of job demands is often contingent on factors that reflect people's cognitive capabilities, reduce demands on their cognitive resources, or compensate for their lack of cognitive resources (Demerouti et al., 2001; Schaufeli & Bakker, 2004), research on executive job demands has not yet examined the boundary conditions of executive job demands theory.

Top Executives and Innovations

Top executives play critical roles in influencing both overall firm innovation and the balance between exploration and exploitation. Their cognitive ability to recognize innovation opportunities and integrate knowledge to create innovation is key to achieving success in overall innovation (Cao, Simsek, & Jansen, 2015; Cao et al., 2010). Their ability to differentiate between exploratory and exploitative opportunities also has major impacts on a firm's share of exploratory innovations (Heavey & Simsek, 2017; Smith & Tushman, 2005). In addition, research has shown that top executives' long-term orientation and risk-taking propensity are major behavioral mechanisms that affect both overall innovation and share of exploratory innovations (Crossan & Apaydin, 2010; Heavey, Simsek, Roche, & Kelly, 2009; Ling, Simsek, Lubatkin, & Veiga, 2008). Moreover, a firm's overall innovation and its share of exploratory innovations are significantly influenced by top executives' resource allocation decisions and the level of centralization versus decentralization of their decision-making (Cao et al., 2015; Damanpour, 1991; Heavey & Simsek, 2013; Lubatkin et al., 2006; Smith, Collins, & Clark, 2005). We build on these studies to explain how top executives' job demands influence firms' overall innovation and share of exploratory innovations.

Executive Job Demands, Overall Innovation, and Share of Exploratory Innovations

Executive job demands can boost information processing demands on top executives, forcing them to selectively attend to a narrow range of information and causing them to process information with biases (Hambrick et al., 2005), thus reducing their ability to identify innovation opportunities and integrate knowledge to create innovation. Specifically, research has shown that working long hours and physical exhaustion reduce people's ability to attend to important cues in the environment (Covassin, Weiss, Powell, & Womack, 2007). Executive job demands can thus weaken executives' abilities to attend to internal and external innovation opportunities.

Under high job demands, top executives are also likely to economize on their limited cognitive resources by using various heuristics in processing information (Bazerman & Moore, 2012; Dolan, 2002). For instance, they may use the availability heuristic and focus their attention on readily available information (Gilovich, Griffin, & Kahneman, 2002), such as technologies or innovation opportunities in familiar domains, reducing their ability to identify all innovation opportunities and damaging their firm's overall innovation performance (Tripsas & Gavetti, 2000). In addition, psychological research has shown that job demands often consume cognitive and emotional resources, reducing the ability to

integrate information in creative ways and impeding divergent thinking (Guilford, 1967; Isen, Johnson, Mertz, & Robinson, 1985). Top executives under high job demands are thus likely to use existing ways of integrating knowledge (Henderson & Clark, 1990) and miss opportunities to combine knowledge in creative ways to achieve innovation (Ahuja & Lampert, 2001; Levinthal & March 1993).

Executive job demands can also negatively affect a firm's overall innovation by weakening executives' long-term orientation and reducing their risk-taking tendency, which are two key behavioral antecedents of innovation (Ling et al., 2008). Pursuing more long-term goals and delaying gratification require more cognitive and emotional resources (see review by Metcalfe & Mischel, 1999), which are scarce among executives under high job demands. In addition, individuals under high job demands tend to focus on addressing pressing issues with available solutions, exhibiting reduced tendency to take risks that are necessary for achieving innovation success (March & Simon, 1958; Tripsas & Gavetti, 2000). For example, formulating a long-term strategic plan to achieve innovation success requires executives to analyze long-term trends in the environment and overcome fears of failure under high uncertainty (Cao et al., 2015; Ling et al., 2008; Smith et al., 2005; Vuori & Huy, 2016). When higher job demands consume more of top executives' cognitive and emotional resources, they are less able to process information about formulating and implementing long-term goals and are more likely to focus on addressing urgent issues with familiar solutions, leading to worse innovation outcomes.

In addition, top executives under higher job demands are likely to choose more centralized (versus decentralized) decision-making processes to preserve their limited cognitive resources and gain control over their job environment (Damanpour, 1991; Van der Doef & Maes, 1999). They are also more likely to allocate resources to activities that deliver more certain outcomes at a faster speed to alleviate the job demands on them (Crossan & Apaydin, 2010; Karasek, 1979) and reduce the resources allocated to innovation due to its uncertain and long-term nature (March & Simon, 1958). The centralization of decisions and reduced investment in innovation are known to have detrimental effects on firms' overall innovation (Chen, Liu, & Tjosvold, 2005; Smith et al., 2005).

In sum, executive job demand negatively affects overall innovation because it reduces top executives' ability to identify innovation opportunities and integrate knowledge in creative ways. It weakens executives' long-term orientation, reduces their risk-taking propensity, increases decision centralization, and reduces the resources allocated to innovation activities. Therefore,

Hypothesis 1. The greater the job demands on top executives, the worse the firm's overall innovation.

Job demands can make it more difficult for top executives to create exploratory innovations than exploitative ones. Increased job demands can make executives selectively attend to familiar rather than exploratory information and rely on heuristics that focus on available and certain opportunities (Bazerman & Moore, 2012), reducing their ability to differentiate exploratory opportunities from exploitative ones and favoring exploitation over exploration. In addition, the reduced ability of top executives to engage in divergent thinking under high job demands (Byron, Khazanchi, & Nazarian, 2010; Guilford, 1967; Isen et al., 1985) also harms exploratory innovations more than exploitative innovations. This is because exploratory innovations involve the creation of new knowledge and new products for emerging customers, and divergent thinking is required for every step of the exploration process (Henderson & Clark, 1990; Smith & Tushman, 2005).

Moreover, because top executives tend to pursue short-term goals and less risky strategies under high job demands (Hambrick et al., 2005; Metcalfe & Mischel, 1999), executive job demands can damage exploratory innovations more than exploitative ones. Although both types of innovation activities require a long-term orientation and a risk-taking propensity, exploratory innovations typically take longer to achieve and involve greater risk than exploitative innovations (Levinthal & March 1993; Ling et al., 2008; Simsek, 2009). In addition, because top executives under high job demands are likely to choose more centralized decision-making processes and allocate fewer resources to uncertain innovation projects (Crossan & Apaydin, 2010; Damanpour, 1991; Van der Doef & Maes, 1999), their choices can have a more negative impact on exploratory innovations than on exploitative ones. Research has shown that centralized decision-making (Crossan & Apaydin, 2010; Jansen, Van den Bosch, & Volberda, 2006) and scarcity of innovation resources (Cyert & March 1963; Nohria & Gulati, 1996) harm exploration more than exploitation. Thus,

Hypothesis 2. The greater the job demands on top executives, the lower the firm's share of innovations that are exploratory.

Our first two hypotheses suggest that top executives—who, like others, have limited cognitive abilities—are less able to process information as rational decision makers when job demands are higher, leading to worse overall firm innovation and a lower share of exploratory innovations. Because the effect of job demands often depends on people's cognitive capabilities or factors that either reduce demand on their cognitive resources or compensate for the lack of such resources (Demerouti et al., 2001; Schaufeli & Bakker, 2004), we further examine below how the effect of executive job demands is contingent on executives' cognitive abilities (by virtue of TMT variety in gender, age, and tenure), a controlling climate that reduces demand on top executives' cognitive resources, and organizational resources (i.e., an innovative climate and employees' education) that compensate for executives' lack of cognitive resources. Our choice of moderators is not only guided by the job demands–resource model (Bakker & Demerouti, 2007) but is also consistent with research on innovation that has emphasized that TMT variety, organization climate, and employees' education are key factors that moderate the influence of top executives on innovation outcomes (Argote, 1999; O'Reilly, Chatman, & Caldwell, 1991; Smith et al., 2005).

Moderating Effect of Variety in Executives' Gender, Age, and Tenure

Research on team diversity has distinguished different types of heterogeneity within a team, including separation, variety, and disparity (Harrison & Klein, 2007). Bunderson and Van der Vegt (2018) further differentiated horizonal from vertical heterogeneity within a team. In this study, we focus on the horizontal variety in top executives' gender, age, and tenure for several reasons. First, we seek to understand how a TMT's diversity in major characteristics may moderate the effect of job demands on innovation outcomes by influencing executives' cognitive abilities. Harrison and Klein (2007: 1203) suggested that variety is more appropriate than separation and disparity in understanding outcomes related to creativity and innovation, especially from an information processing perspective. Bunderson and Van der Vegt (2018) showed that most studies on management teams have focused on horizontal heterogeneity, and our study follows this tradition in strategic leadership research. Second, research on TMTs and innovation management has suggested that executives develop different perspectives on issues related to innovation according to their gender (Dezsö & Ross, 2012), age (Bantel & Jackson, 1989; Wiersema & Bantel, 1993), and tenure (Barkema & Shvyrkov, 2007), making these three characteristics especially relevant to our study.

The horizontal variety in top executives' gender, age, and tenure can reflect their cognitive abilities and weaken the negative effects of job demands on overall innovation and share of exploratory innovations. Strategic leadership research has suggested that the horizontal variety in top executives' gender, age, and tenure reflects the variety in their knowledge, experience, and cognition (Finkelstein et al., 2009), enabling them to draw from different perspectives in decision-making. While TMT members under high job demands are especially prone to the influence of heuristics and biases in decision-making (Hambrick et al., 2005; Hambrick & Mason, 1984), the variety in their gender, age, and tenure can lead them to make different judgments individually, creating cognitive conflicts among them (Hambrick, Cho, & Chen, 1996; Qian et al., 2013; Zhu & Shen, 2016). In resolving these cognitive conflicts, executives are likely to thoroughly exchange their diverse knowledge and perspectives, weakening the negative effects of heuristics and biases on their ability to identify innovative opportunities and differentiate exploratory and exploitative opportunities under high job demands (Elenkov, Judge, & Wright, 2005; Smith et al., 2005). For example, although top executives under high job demands may use the availability heuristic and focus on the technologies with which they are most familiar, variety in gender can lead them to attend to a range of different technologies, "especially those that relate to female customers, employees, and trading partners" (Dezsö & Ross, 2012: 1075). Variety in executives' gender, age, and tenure thus helps them to collectively exhibit stronger cognitive abilities, mitigating the negative effect of job demands on overall innovation.

In addition, because increased executive job demands do more harm to top executives' ability to identify exploratory opportunities than to identifying exploitative ones, variety in executives' gender, age, and tenure can also alleviate the negative effect of job demands on exploration more than on exploitation—the diversity of top executives' perspectives is helpful for identifying exploitative opportunities but critical for identifying exploratory opportunities and differentiating them from exploitative opportunities (Ahuja & Lampert, 2001; Isen et al., 1985; Simsek, 2009).

Variety in top executives' gender, age, and tenure also enables them to better integrate diverse

knowledge held by other employees (Qian et al., 2013; Smith et al., 2005), alleviating the negative effects of heuristics and biases on their ability to integrate knowledge to create innovations. For instance, while a team of short-tenured top executives under high job demands may focus only on knowledge held by employees who have performed well in recent years, tenure variety among TMT members can allow executives to further consider knowledge held by employees who performed well in the distant past (Srivastava & Lee, 2005). Moreover, variety in executives' gender, age, and tenure can be more important in mitigating the negative effect of job demands on exploration than on exploitation. As discussed above, top executives under high job demands may still be able to integrate knowledge in familiar ways to create exploitative innovations, but they will not be able to integrate knowledge in highly novel fashions to create exploratory innovations or differentiate exploratory and exploitative opportunities without variety in executives' gender, age, and tenure. Therefore,

Hypothesis 3. The greater the horizontal variety in top executives' gender, age, and tenure, the weaker the negative relationship between executive job demands and the firm's overall innovation.

Hypothesis 4. The greater the horizontal variety in top executives' gender, age, and tenure, the weaker the negative relationship between executive job demands and the firm's share of innovations that are exploratory.

Moderating Effect of Organizational Climate

Organizational climate reflects the collective attitudes and beliefs held by employees about how to perform their jobs (O'Reilly et al., 1991; Tsui, Wang, & Xin, 2006). Research on knowledge management has highlighted that organizational climate can substantially influence a firm's overall innovation and share of exploratory innovations because it reflects a firm's strategic values, beliefs, and assumptions about how the firm should function (Chatman & Jehn, 1994; Smith et al., 2005). Two types of organizational climate are especially relevant to firm innovation: controlling climate and innovative climate (Smith et al., 2005; Weick & Westley, 1996). These are two distinct, although related, dimensions of organizational climate that are not entirely controlled by top executives (Tsui et al., 2006).

Many firms have a climate that emphasizes systematic management and control. In such a controlling climate, employees are given clear goals and are evaluated by using well-established performance standards (Benner & Tushman, 2002; Tsui et al., 2006). They are also expected to follow a comprehensive system of management and control, with clearly articulated rules and regulations for keeping strict discipline at work (Weick & Westley, 1996). A controlling climate may have opposite effects on the extent to which executive job demands influence overall innovation and share of exploratory innovations.

A controlling climate can free top executives from the need to attend to issues related to their firms' operational details and reduce demands on their limited cognitive resources, alleviating the negative effect of job demands on overall innovation. Specifically, the behavioral theory of the firm suggests that decision makers rely on organizational routines to guide employees' daily activities in part to economize on their relatively scarce cognitive resources (Cyert & March 1963; Levinthal & March 1993; March & Simon, 1958). Because a controlling climate encourages the use of routines, it protects the relatively scarce cognitive resources that top executives have under high job demands. In contrast to a firm with a weak controlling climate, a firm with a strong controlling climate allows top executives to focus their scarce cognitive resources on the most important innovation issues rather than on operational details, ensuring the allocation of proper resources to support innovation activities (Tsui et al., 2006; Weick & Westley, 1996). Although top executives under higher job demands are less able to identify innovation opportunities or integrate knowledge to create innovation, the negative effect of executive job demands can be alleviated when top executives are protected by a controlling climate and are able to create innovation as much as their limited cognitive resources allow. Thus,

Hypothesis 5. The stronger a firm's controlling climate, the weaker the negative relationship between executive job demands and the firm's overall innovation.

A controlling climate can reduce the negative effect of executive job demands on exploitation more than on exploration, exacerbating the negative effect of executive job demands on the share of exploratory innovations. Specifically, research on innovation has shown that a controlling climate and the associated top–down approach are positively associated with executives' exploitative activities but not associated with their exploratory activities (Mom, Van den Bosch, & Volberda, 2007; Smith

et al., 2005). While a controlling climate reduces demand on executives' cognitive resources, executives under high job demands tend to utilize these resources for examining exploitative opportunities more than exploratory ones (Crossan & Apaydin, 2010). This is because top executives in a strong controlling climate are more familiar with and used to exploitation than exploration—they tend to use centralized decision-making processes and take calculated risks (Mom et al., 2007; Zimmermann, Raisch, & Birkinshaw, 2015). Because executives rely more on heuristics and favor familiar practices over others under higher job demands, the stronger a firm's controlling climate, the more top executives under high job demands will favor exploitation over exploration, leading to an even lower share of exploratory innovations. Thus,

Hypothesis 6. The stronger a firm's controlling climate, the stronger the negative relationship between executive job demands and the firm's share of innovations that are exploratory.

A firm with a strong innovative climate values the development of new products, services, technologies, and processes and encourages employees to experiment with new ideas for exploration (Tsui et al., 2006). Although top executives under high job demands have limited abilities to identify innovation opportunities and integrate knowledge for innovation, a highly innovative climate encourages employees to identify these opportunities and proactively integrate knowledge to achieve innovation, especially for exploratory innovation (Smith et al., 2005). They can bring these innovation opportunities to the attention of top executives, compensating for the lack of top executives' cognitive abilities under high job demands and alleviating the negative effect of executive job demands on both overall innovation and share of exploratory innovations.

In addition, under a strong innovative culture, middle-level managers and other employees are also encouraged to proactively take risks and champion their initiatives, achieving innovation, especially exploratory innovation, by following a bottom–up process that complements the top–down process driven by top executives alone (Day, 1994; Zimmermann et al., 2015). Although executives under high job demands tend to prefer short-term goals, certain strategies, and centralized decision-making, they have limited abilities to change a company's innovative culture and have to consider bottom–up processes as legitimate and valuable, allocating more resources to employee-driven initiatives than executives in a less innovative culture. Because an innovative climate and the associated bottom–up process for innovation are known to promote innovations, especially exploratory innovations (Mom et al., 2007), an innovative climate can serve as a job resource that compensates for executives' lack of cognitive abilities, weakening the negative effect of job demands on both overall innovation and share of exploratory innovations. Thus,

Hypothesis 7. The stronger a firm's innovative climate, the weaker the negative relationship between executive job demands and the firm's overall innovation.

Hypothesis 8. The stronger a firm's innovative climate, the weaker the negative relationship between executive job demands and the firm's share of innovations that are exploratory.

Moderating Effect of Employees' Education

Many studies on organizational learning and knowledge management have emphasized that employees are a primary repository of organizational knowledge (Argote, 1999; Chang, Gong, Way, & Jia, 2013; Simsek & Heavey, 2011; Smith et al., 2005). The abilities and skills that employees acquired through their formal education constitute their general human capital (Harris & Helfat, 1997; Smith et al., 2005) and reflect mental abilities that are useful in a broad range of settings, especially in affecting employees' overall creativity (Schmidt & Hunter, 2004).

Educated employees are known to have advanced knowledge structures and cognitive reasoning skills, enabling them to absorb new knowledge (Cohen & Levinthal, 1990), exchange knowledge with top executives and others (Simsek & Heavey, 2011; Smith et al., 2005), and combine knowledge to initiate innovative projects (Argote, 1999). While top executives under high job demands have a reduced ability to identify innovation opportunities or integrate knowledge to create innovation, educated and skillful employees are capable of helping top executives to correct their limited field of vision, biased reasoning, and ineffective information processing (Dietrich & Kanso, 2010; Smith et al., 2005). Thus, educated employees represent a key type of job resource that can compensate for the limited cognitive abilities of executives under high job demands, weakening the negative effect of job demands on overall innovation. Thus,

Hypothesis 9. Employees' education weakens the negative relationship between executive job demands and the firm's overall innovation.

Although educated employees can alleviate the negative effect of executive job demands on a firm's overall innovation, they can exacerbate the negative effect on the firm's share of exploratory innovations. This is because employees typically innovate in ways that reward them (Tripsas & Gavetti, 2000). As discussed above, top executives under higher job demands are more likely to focus on short-term goals and more familiar and certain innovation opportunities (i.e., exploitation) in order to economize on their scarce cognitive and emotional resources (Ahuja & Lampert, 2001; Levinthal & March 1993; Vuori & Huy 2016). They are also likely to use centralized decision-making processes to gain control over their job environment, exercising greater influence over key resource allocation decisions (Damanpour, 1991; Hambrick et al., 2005; Van der Doef & Maes, 1999). Accordingly, educated employees are more likely to be rewarded if they focus on identifying opportunities for and creating exploitative innovations rather than exploratory innovations when executives are under high job demands—initiatives to create exploitative innovations are more likely to be appreciated and funded by top executives than efforts to create exploratory innovations. Thus, although educated employees can alleviate the negative effect of executive job demands on both types of innovations, they weaken the negative effect on exploitation more than on exploration, exacerbating the negative effect of executive job demands on a firm's share of exploratory innovations. Thus,

Hypothesis 10. Employees' education strengthens the negative relationship between executive job demands and the firm's share of innovations that are exploratory.

METHODS

Sample and Data

Our sample frame consists of firms located in 43 districts in Suzhou, a city in Jiangsu Province, the province that had the highest research and development (R&D) investment and second-largest gross domestic product (GDP) in China at the time of our study in 2015. We obtained a comprehensive list of firms from local governments and randomly selected about 10 representative firms from each district, resulting in 412 firms in our initial sample of survey targets. We asked local government officials in charge of business and the economy to help us arrange site visits to our survey targets; 404 of the 412 firms agreed to participate in our on-site surveys. Only a handful of firms in our sample were public; the overwhelming majority were owned by a single owner or a family. These firms did not have a board, and the TMT typically included the primary owners. On average, these firms had 481 employees and about US$85 million in revenue.

During our visit to each firm, we asked six members of the TMT to participate in our survey. Interviews conducted during the pre-test phase suggested that TMTs at the firms in our sample typically included the CEO or the vice CEO, the director of human resources, the administrative director, the financial director, the procurement director, and the production or technological director. While we asked all of these executives to participate in our survey, to ensure the accuracy of their responses, we asked them to complete questionnaires tailored to their areas of expertise. In 70% of the firms, all six top executives completed their questionnaires. Each participant received a business card from our research team, a bookmark, and an explanation of our confidentiality commitments. We also asked different executives to provide information on subjective measures to assess inter-rater reliability. Table A1 of Appendix A contains a summary of the informants for our key study variables and the ICC1 agreement scores, which showed satisfactory levels of inter-rater reliability and consistency for all subjective measures (Bliese, 2000).

Missing values for variables reduced our final sample size to 243 observations (i.e., firms).[1] Our effective response rate, calculated as the number of usable questionnaires divided by the total number of questionnaires sent to the initial sample (e.g., Cao et al., 2015; Heavey & Simsek, 2015; Nadkarni & Hermann, 2010; Westphal & Graebner, 2010), was thus 59%, making it relatively high among surveys of top executives. Two-sample *t*-tests revealed no systematic differences in the key attributes of responding

[1] In our primary analysis, we used responses from the CEO or vice CEO to measure innovation and used responses from the administrative director to measure job demands. In an additional analysis, we also used responses from the CEO or vice CEO to measure job demands, and the sample size was increased to 323 firms. Because the findings from both analyses provided consistent support for our hypotheses, we used the smaller sample to minimize common source biases and to provide a conservative test of our theory.

and nonresponding firms, including firm age, size, and ownership. Although firms included in our sample represented various high-tech industries in Jiangsu, including manufacturing, transportation, oil processing, and software development, they may not represent the larger population of entrepreneurial firms in China. We thus further conducted Heckman analyses to address potential sample selection issues (the details of which are provided in the analysis section).

To minimize common source variance, we asked different top executives to provide information about our dependent and independent variables (see Table A1 of Appendix A for a summary). We also used two objective measures of innovation in our robustness analyses, reported below. In addition, we conducted several analyses to evaluate the degree of common method bias in our data but found no evidence of concern (see Appendix A for details).

Measures[2]

Dependent variable. Innovation was measured using the 12-item scale developed and validated by Jansen et al. (2006). The scale includes six items to measure exploratory innovations and six items to measure exploitative innovations in all major areas of business operations (Jansen et al., 2006). Examples of survey items include "Our firm invents new products and services" and "We regularly use new distribution channels." Executives were asked to rate their responses to these questions on a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Because exploratory and exploitative innovations are two primary types of innovation that compete with one another for limited innovation resources (Levinthal & March 1993; March 1991; Tushman & O'Reilly, 1996), combining both types of innovation should allow us to capture the overall innovation of a firm very well. We thus used the simple average of the 12 items to measure a firm's overall innovation ($\alpha = 0.94$).

We further used six items each to measure exploratory innovations ($\alpha = 0.91$) and exploitative innovations ($\alpha = 0.90$). Results from confirmatory factor analyses (reported in Table A3 of Appendix A) showed that either a one-factor or two-factor model fit the data satisfactorily. This confirms that it is appropriate to use six items each to measure exploratory and exploitive innovations and use all 12 items to measure overall innovation.

We followed existing studies (e.g., Benner & Tushman, 2002; Uotila et al., 2009) to calculate the share of exploratory innovations as exploratory innovations divided by the sum of exploratory and exploitative innovations after standardization.[3] In additional analyses, we used objective indicators of overall innovation (i.e., patent counts) and exploratory innovation (i.e., new product sales) and obtained consistent support for the hypothesized effect of executive job demands (details are provided in the robustness analysis section).

Independent variables. Studies on job demands on individual workers have typically used survey scales and asked respondents to assess this objective characteristic of their job environment. However, as discussed earlier, established scales for measuring job demands on employees are not ideal in the context of top executives because there are substantial differences in their job characteristics (Finkelstein et al., 2009; Norburn, 1989). One alternative approach is to use causal indicators (Bollen & Bauldry, 2011), which are proximate antecedents of executive job demands that can be evaluated by multiple informants with reasonable accuracy. Thus, we built on Hambrick et al. (2005) and used several causal indicators to measure executive job demands.

Specifically, *task challenges* arise from environment dynamism and environment hostility. Following Miller (1987), we measured *environment dynamism* using a 3-item survey scale.[4] Executives were asked to assess their firm's external environment over the past three years on a 6-point Likert scale, ranging from 1 (*strongly disagree*) to 6 (*strongly agree*); α was 0.84, reflecting relatively high inter-item reliability. *Environment hostility* was

[2] We followed the standard procedure of reverse translation to ensure the semantic equivalence of our measures in English and Chinese. We also conducted a pilot study with 160 top executives and used their feedback to improve the questionnaires.

[3] While using ratios as the dependent variable has raised concerns from methodological experts (e.g., Certo, Busenbark, Kalm, & LePine, 2020), the coefficient of variation of our denominator (i.e., overall innovation) is 0.16, which is far below the alarming level of 1 (Certo et al., 2020: 212, 215). In addition, Dunlap, Dietz, and Cortina (1997) confirmed that using ratios is not a concern when the denominator's coefficient of variation is around 0.15.

[4] We removed one item ("R&D activity in our principal industry has substantially increased") from the original scale because it overlapped with the construct of innovation. Our results held when all items in the original scale were used.

measured in terms of *hostile suppliers and buyers* and *hostile competitors.* Relationships with suppliers and buyers were measured using an 8-item survey scale from Meeus, Oerlemans, and Hage (2001); α was 0.91. Relationships with competitors were measured using a 3-item scale from Mesquita and Lazzarini (2008); α was 0.92. Because higher values of these indicators represented friendlier environments, we reverse-coded them and used the average of their standardized scores to obtain our measures of hostile suppliers and buyers, and hostile competitors.

Performance challenge was calculated as the percentage of sales growth from 2013 to 2014 minus the average sales growth rate of firms in the same industry in the same period. We reverse-coded this variable so that higher values of performance challenge corresponded to lower sales growth relative to the industry average. Behavioral research on aspiration levels has suggested that decision makers typically refer to the historical performance of their firms and the performance of other firms in the same industry when deciding their aspiration levels (Cyert & March 1963; Greve, 1998). In addition, studies on entrepreneurial firms have often used sales as a key measure of firm performance (e.g., Lubatkin et al., 2006). Our measure of performance challenge thus reflected the degree to which a firm's performance deviated from previous performance and from peer performance.

Executive aspirations were measured by using the CEO's need for achievement, as suggested by Hambrick et al. (2005). *Need for achievement* was measured using the 18-item Achievement Motive Questionnaire developed and validated by Elizur (1979) and Sagie and Elizur (1999); α was 0.93. Because lower scores denote higher levels of need for achievement, we first reverse-coded these indicators and then used the sum of their standardized scores to obtain our measure of need for achievement.

The above indicators of job demands are causal or formative indicators of executive job demands—they are proximate antecedents of job demands. Because formative indicators of a latent construct capture its antecedents, they are not expected to correlate with one another (see Bollen & Bauldry, 2011; Bollen & Diamantopoulos, 2017). We thus used the sum of the standardized scores of the above measures to generate a single index of job demands. Table A2 in Appendix A reports the descriptive statistics on our measures of job demands.

While the validity of causal or formative indicators is typically evaluated based on theoretical expectations (Bollen & Diamantopoulos, 2017), we sought to further establish the criterion validity of our measures of job demands with a validation study. Specifically, in 2019, we conducted an original survey of 117 top executives enrolled in the executive program of a leading business school in Jiangsu Province. Seventy-four (i.e., 63%) of them provided complete responses. The survey included all of our formative indicators of executive job demands. In addition, it included reflective indicators of job demands developed and validated by Gonzalez-Mulé and Cockburn (2017). The α for these measures varied from between 0.81 and 0.89, showing satisfactory levels of convergent validity. The index of executive job demands based on formative indicators was correlated with the index based on reflective indicators at 0.62 ($p < 0.001$), providing evidence for the convergent validity of our measure of job demands. In addition, the index of executive job demands based on formative indicators was significantly correlated with executive job satisfaction (measured using the scale from Brayfield & Rothe, 1951) at -0.13 ($p < 0.01$). Because job satisfaction is one of the most studied constructs related to job demands, our data also showed evidence of the discriminative validity of our measure of job demands.

It is worth reporting that we followed existing studies that surveyed TMT members about strategic issues and asked multiple knowledgeable top executives to provide information on a given indicator (McDonald & Westphal, 2003, 2010; Zhang, Zhong, & Makino, 2015). These studies emphasized that not all members of the TMT are adequately informed about all strategic issues, which is a key difference from an average work team, so it would not be appropriate to use a TMT-level consensus rating to measure all causal indicators of job demands. Table A1 in Appendix A reports satisfactory levels of interrater reliability for our measures.

Variety in executives' gender, age, and tenure (*TMT variety*) was measured using the sum of standardized scores of variety in gender, age, and tenure. Variety in gender was measured using Blau's index, calculated as $1-\sum P_i^2$, where P_i is the percentage of executives in each gender category (Harrison & Klein, 2007; Westphal & Zajac, 1995). Variety in age and tenure were both measured by the ratio of the standard deviation to the mean (Zhu & Shen, 2016). *Controlling climate* and *innovative climate* were measured using the survey questionnaires developed and validated by Tsui et al. (2006). Four items were included in each survey scale; the α was 0.93 for controlling climate and 0.88 for innovative climate. *Employees' education* was measured using the percentage of employees with at least a bachelor's

degree (Gattiker, 1995; Khanna, Jones, & Boivie, 2014). We centered the moderating variables when creating the interaction terms.

Control variables. Because governments in emerging economies often provide important innovation resources to firms, we followed prior research (e.g., Boubakri, Mansi, & Saffar, 2013) and controlled for a firm's *ties to the government* by using a 4-item survey scale. For each district, we surveyed four government officials who oversaw coordination with local firms. They assessed the frequency of government–firm interactions and the proactiveness of these interactions on a 5-point Likert scale; α was 0.84, and ICC1 was 0.32 ($p < 0.01$). We used their average response to measure a firm's ties to the government. We further included two variables to control for the influence of technological competition on firm innovation. Specifically, *fear of imitation* was measured by the degree to which a firm applied for patents in response to imitation by rivals (Giarratana & Mariani, 2014). *Industry innovation* was measured by the industry average percentage of sales from new products (Ethiraj & Zhu, 2008).

At the firm level, we controlled for *firm age*, *firm size* (measured by total assets), and *R&D* expenditure (Cohen & Levinthal, 1990; Heavey & Simsek, 2017; Lubatkin et al., 2006; Qian et al., 2013). We further controlled for *firm ownership* by using four dummy variables reflecting whether a firm was state owned, privately owned, a Sino–foreign joint venture, or foreign owned. We also included industry dummies in all models. Research has shown that firm ownership and industry of affiliation can both influence innovation outcomes (e.g., Zhou, Gao, & Zhao, 2017). At the TMT level, we controlled for *TMT male ratio* (i.e., percentage of male executives), *TMT mean age*, and *TMT mean tenure*. Upper echelons research has emphasized that these TMT attributes can influence strategic outcomes, including firm innovation (Finkelstein et al., 2009). A top executive's age was measured in nine intervals from 1 (under 26) to 9 (over 60), with five years included in each interval. We also controlled for whether the CEO or vice CEO participated in our survey on firm innovation, using a binary variable (*CEO title*) set to 1 if the CEO participated and 0 otherwise. In an additional analysis, we used the subsample that included CEOs only and still found consistent support for our theory. In a separate analysis, we further controlled for the CEO's gender, age, tenure, education, and transformational leadership. None of these variables had a significant effect on the outcome, and our results were unchanged with or without controlling for them. To avoid overfitting the model, we excluded them from our primary analysis (all results are available upon request).

Analyses

We conducted a Heckman two-stage sample selection analysis to address potential sample selection issues (Heckman, 1979). Specifically, the first-stage selection model used a large sample of firms that were traded in China's "New Third Board" market and our sampled firms to predict the likelihood that a firm was included in our final analysis.[5] The likelihood-ratio test of independent equations showed evidence of sample selection bias, and hence we included the inverse Mills ratio generated by the first-stage analysis in our second-stage ordinary least squares (OLS) regressions to correct for sample selection biases (Certo, Busenbark, Woo, & Semadeni, 2016).

Results

Summary statistics and binary correlations among variables are provided in Table 1. Variable means and standard deviations reflect values before transformation. Results from OLS regressions on overall innovation and share of exploratory innovations are reported in Tables 2 and 3, respectively. In each table, model 1 includes control variables only and models 2–6 add one hypothesized variable each time to the model. Model 6 in each table is the complete model, and we discuss our findings based on it.

With a sample size of 243, five tested effects, and 33 controls, our complete models on overall innovation and share of exploratory innovations have a power of 0.99 and 0.83, respectively, relative to models with controls only. The power of our complete models is thus above the acceptable threshold of 0.80. Figure A1 of Appendix A further shows how the power of the complete model varies across

[5] Firms traded in the New Third Board market are not public firms but rather represent small and medium companies from all provinces in China. Three predictive variables in the first-stage analysis were not included in the second-stage model and had significant effects on selection, satisfying the exclusion restriction requirement of the Heckman analysis. They were (a) a firm's geographic distance from Jiangsu Province, (b) the GDP growth rate of a firm's headquarters province, and (c) the market development index of a firm's headquarters province. These variables captured the geographical, economic, and institutional differences among firms.

TABLE 1
Descriptive Statistics and Binary Correlations (N = 243)

Variable	Mean	*SD*	1	2	3	4	5	6	7
1. Overall innovation	5.78	0.92							
2. Share of exploratory innovation	0.62	1.33	0.00						
3. Executive job demands	0.00	0.47	−0.23	−0.05					
4. TMT variety	0.32	1.84	−0.03	0.00	0.01				
5. Controlling climate	5.88	1.03	0.13	0.05	−0.02	0.00			
6. Innovative climate	6.05	0.92	0.14	0.03	−0.01	0.08	0.64		
7. Employees' education	0.34	0.28	−0.03	0.08	0.04	0.15	−0.01	0.16	
8. Fear of imitation	6.15	1.23	0.13	0.03	0.14	0.10	−0.05	−0.02	0.17
9. Industry innovation	0.42	0.17	0.02	0.11	0.04	0.11	−0.02	0.01	0.30
10. Ties to government	1.93	0.42	0.17	0.01	−0.04	0.06	0.12	0.12	0.17
11. Firm age	13.23	8.42	0.08	−0.08	−0.04	−0.18	0.06	−0.04	−0.34
12. Firm size	0.05	0.14	0.05	−0.05	0.02	−0.15	0.13	0.07	−0.06
13. R&D	1.17	2.36	0.07	−0.06	−0.01	−0.11	0.14	0.13	−0.01
14. TMT tenure	7.52	4.45	0.01	−0.04	−0.03	−0.41	0.02	−0.11	−0.39
15. TMT age	4.02	0.93	−0.02	−0.06	0.02	−0.34	−0.07	−0.10	−0.32
16. TMT gender	0.55	0.22	0.02	−0.05	0.03	−0.16	0.05	0.09	−0.09
17. CEO title	0.46	0.50	−0.08	0.06	0.09	0.09	0.05	0.12	−0.02
Variable	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
9. Industry innovation	0.12								
10. Ties to government	0.01	0.20							
11. Firm age	−0.07	−0.21	0.24						
12. Firm size	−0.06	−0.05	0.22	0.32					
13. R&D	0.03	−0.03	0.25	0.22	0.60				
14. TMT tenure	−0.09	−0.27	−0.01	0.67	0.11	0.10			
15. TMT age	−0.11	−0.13	−0.06	0.37	−0.05	0.04	0.65		
16. TMT gender	−0.17	−0.03	0.04	0.10	0.14	0.16	0.21	0.39	
17. CEO title	−0.07	−0.11	−0.20	−0.13	−0.20	−0.13	−0.05	0.08	0.00

Note: Coefficients are significant at $p < .05$ when absolute values are greater than 0.13.

different levels of R^2. In addition, in both complete models, the power of an effect that is significant at 0.05 is 0.99, and the power of an effect that is marginally significant at 0.10 is 1.00. Figure 2A in Appendix A further demonstrates how the power of a significant effect would vary across different sample sizes.

Hypotheses 1 and 2 predict that *executive job demands* negatively influence both overall innovation and share of exploratory innovations. Results from model 6 in Tables 2 and 3 show that the coefficient of *executive job demands* is negative and statistically significant at $p < 0.001$ and $p < 0.10$, respectively. These findings thus provide strong support for Hypothesis 1 and marginal support for Hypothesis 2 (see Farh, Oh, Hollenbeck, Yu, Lee, & King, 2020; Lee, Yoon, & Boivie, 2020; Li, Hernandez, & Gwon, 2019). Holding moderating variables at their means and other variables constant, an increase in *executive job demands* from one standard deviation below the mean to one standard deviation above the mean decreases a firm's *overall innovation* by 0.51 (or 0.55 standard deviations) and decreases a firm's *share of exploratory innovations* by 0.28 (or 0.21 standard deviations). These findings thus support Hypothesis 1 and Hypothesis 2.

Results from model 6 in Tables 2 and 3 also show that the coefficient of the interaction term between *variety in executives' gender, age, and tenure* and *executive job demands* is significantly positive at $p < 0.10$ and $p < 0.05$, respectively. These findings provide marginal support for Hypothesis 3 and support for Hypothesis 4, which predict that variety in executives' gender, age, and tenure attenuates the negative effect of executive job demands on both overall innovation and share of exploratory innovations. Figures 1 and 2 illustrate the moderating effect of TMT variety, showing the effect of job demands when TMT variety is low (i.e., one standard deviation below the mean), at its mean, and high (i.e., one standard deviation above the mean). As shown in these figures, TMT variety has an especially strong moderating effect on share of exploratory innovations, such that the negative effect of executive job

TABLE 2
Heckman Sample Selection Models on Overall Innovation (n = 243)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Executive job demands		−0.449***	−0.509***	−0.499***	−0.498***	−0.539***
		(0.131)	(0.136)	(0.136)	(0.136)	(0.138)
Executive job demands ×			0.115†	0.107†	0.110†	0.097†
TMT variety			(0.072)	(0.072)	(0.074)	(0.075)
Executive job demands ×				0.192†	0.208†	0.287*
Controlling climate				(0.130)	(0.160)	(0.168)
Executive job demands ×					−0.029	−0.183
Innovative climate					(0.187)	(0.213)
Executive job demands ×						0.649†
Employees' education						(0.436)
TMT variety	−0.046	−0.045	−0.041	−0.033	−0.032	−0.029
	(0.038)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Controlling climate	0.050	0.052	0.066	0.061	0.060	0.063
	(0.081)	(0.079)	(0.079)	(0.079)	(0.078)	(0.078)
Innovative climate	0.108	0.101	0.105	0.106	0.105	0.104
	(0.095)	(0.092)	(0.092)	(0.092)	(0.091)	(0.091)
Employees' education	−0.228	−0.261	−0.217	−0.224	−0.221	−0.230
	(0.314)	(0.306)	(0.306)	(0.305)	(0.301)	(0.300)
Inverse Mills ratio	0.057	−0.045	−0.034	−0.080	−0.058	−0.096
	(0.370)	(0.362)	(0.361)	(0.361)	(0.335)	(0.335)
Fear of imitation	0.136*	0.158**	0.157**	0.161**	0.162**	0.154**
	(0.052)	(0.052)	(0.051)	(0.051)	(0.051)	(0.051)
Industry innovation	−0.052	−0.074	−0.101	−0.147	−0.076	−0.162
	(0.640)	(0.624)	(0.622)	(0.621)	(0.480)	(0.483)
Ties to government	0.371†	0.350†	0.323	0.325	0.314†	0.324†
	(0.206)	(0.201)	(0.201)	(0.200)	(0.177)	(0.176)
Firm age	0.009	0.009	0.009	0.008	0.008	0.007
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Firm size	−0.630	−0.365	−0.366	−0.263	−0.254	−0.151
	(0.658)	(0.647)	(0.644)	(0.646)	(0.635)	(0.637)
R&D	−0.011	−0.012	−0.014	−0.017	−0.016	−0.020
	(0.035)	(0.035)	(0.034)	(0.034)	(0.034)	(0.034)
TMT gender	0.190	0.247	0.237	0.210	0.209	0.137
	(0.322)	(0.315)	(0.314)	(0.313)	(0.313)	(0.316)
TMT age	−0.076	−0.044	−0.042	−0.030	−0.029	−0.014
	(0.098)	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)
TMT tenure	−0.007	−0.014	−0.014	−0.015	−0.014	−0.016
	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
CEO title	−0.108	−0.047	−0.059	−0.061	−0.060	−0.091
	(0.135)	(0.132)	(0.132)	(0.132)	(0.131)	(0.132)
Constant	4.408**	4.278**	4.329**	4.330**	4.314**	4.420**
	(0.684)	(0.668)	(0.666)	(0.664)	(0.633)	(0.635)
R^2	0.152	0.197	0.207	0.215	0.215	0.223
Δ R^2 *(from the prior model)*		0.045***	0.010†	0.008†	0.000	0.007†
Δ R^2 *(from model 1 to model 6)*				0.071*		

Notes: n = 7,621 for the first-stage selection model. Standard errors in parentheses. One-tailed test for hypothesized effects; two-tailed test for controls. Industry and ownership type dummies are included in all models.

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 3
Heckman Sample Selection Models on Share of Exploratory Innovations (n = 243)

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Executive job demands		−0.265†	−0.336*	−0.352*	−0.360*	−0.293†
		(0.200)	(0.200)	(0.200)	(0.203)	(0.205)
Executive job demands × TMT variety			0.228*	0.241*	0.232*	0.253*
			(0.106)	(0.106)	(0.110)	(0.110)
Executive job demands × Controlling climate				−0.288†	−0.327†	−0.469*
				(0.191)	(0.237)	(0.248)
Executive job demands × Innovative climate					0.077	0.354
					(0.276)	(0.314)
Executive job demands × Employees' education						−1.187*
						(0.650)
TMT variety	−0.012	−0.009	−0.002	−0.014	−0.015	−0.020
	(0.054)	(0.056)	(0.054)	(0.054)	(0.055)	(0.054)
Controlling climate	0.086	0.049	0.114	0.122	0.122	0.117
	(0.116)	(0.120)	(0.116)	(0.116)	(0.116)	(0.115)
Innovative climate	0.015	0.000	0.018	0.016	0.014	0.021
	(0.137)	(0.140)	(0.135)	(0.135)	(0.135)	(0.135)
Employees' education	0.020	−0.334	0.100	0.113	0.106	0.070
	(0.490)	(0.496)	(0.492)	(0.490)	(0.492)	(0.490)
Inverse Mills ratio	0.008	0.241	−0.003	0.066	0.057	0.097
	(0.532)	(0.541)	(0.530)	(0.530)	(0.532)	(0.530)
Fear of imitation	0.035	0.018	0.043	0.037	0.040	0.054
	(0.075)	(0.078)	(0.075)	(0.075)	(0.076)	(0.076)
Industry innovation	0.635	1.300†	0.528	0.602	0.605	0.692
	(0.868)	(0.773)	(0.861)	(0.860)	(0.862)	(0.858)
Ties to government	0.042	0.128	−0.036	−0.040	−0.028	−0.028
	(0.298)	(0.294)	(0.298)	(0.297)	(0.301)	(0.299)
Firm age	−0.010	−0.012	−0.008	−0.006	−0.006	−0.005
	(0.018)	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)
Firm size	0.046	0.137	0.148	−0.007	0.006	−0.154
	(0.941)	(0.978)	(0.940)	(0.943)	(0.946)	(0.945)
R&D	−0.011	−0.007	−0.016	−0.011	−0.011	−0.005
	(0.051)	(0.053)	(0.050)	(0.050)	(0.050)	(0.050)
TMT gender	−0.288	−0.218	−0.284	−0.244	−0.226	−0.083
	(0.463)	(0.469)	(0.460)	(0.459)	(0.465)	(0.469)
TMT age	0.065	0.002	0.084	0.065	0.066	0.039
	(0.141)	(0.144)	(0.141)	(0.141)	(0.141)	(0.141)
TMT tenure	−0.006	0.006	−0.010	−0.009	−0.010	−0.006
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
CEO title	0.256	0.264	0.262	0.266	0.267	0.322
	(0.194)	(0.201)	(0.194)	(0.193)	(0.194)	(0.195)
Constant	−0.012	−0.246	0.054	0.051	0.011	−0.177
	(0.967)	(0.975)	(0.962)	(0.959)	(0.972)	(0.972)
R^2	0.162	0.173	0.185	0.194	0.195	0.208
Δ R^2 *(from the prior model)*		0.011†	0.012*	0.009†	0.001	0.013*
Δ R^2 *(from model 1 to model 6)*			0.046*			

Notes: n = 7,621 for the first-stage selection model. Standard errors in parentheses. One-tailed test for hypothesized effects; two-tailed test for controls. Industry and ownership type dummies are included in all models.

† $p < .10$

* $p < .05$

demands turns positive at a high level of TMT variety.

Hypothesis 5 predicts that a controlling climate can reduce demands on top executives' cognitive resources and weaken the negative effect of job demands on overall innovation. The coefficient of the interaction term between a *controlling climate* and *executive job demands* is significantly positive at $p < 0.05$ in model 6 of Table 2, providing support for Hypothesis 5. Hypothesis 6 predicts that the

FIGURE 1
Effects of Executive Job Demands on Overall Innovation at Different Levels of TMT Variety

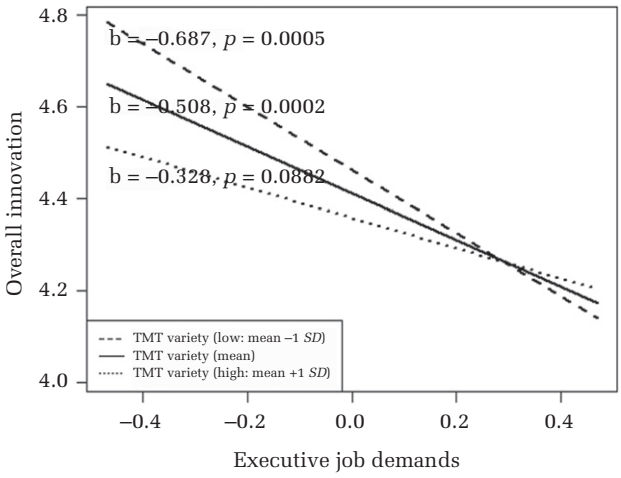
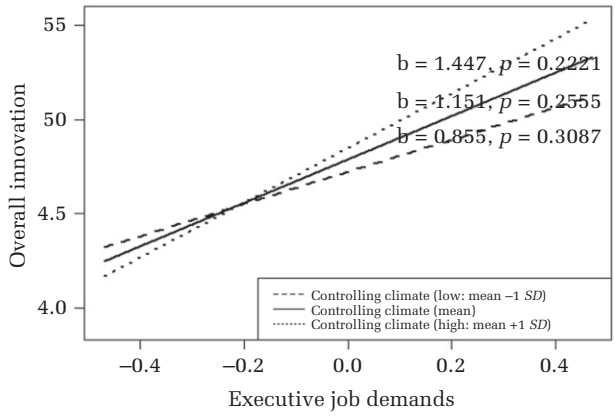


FIGURE 3
Effects of Executive Job Demands on Overall Innovation at Different Levels of Controlling Climate



negative effect of executive job demands on the share of exploratory innovations is exacerbated by a controlling climate. Findings from model 6 of Table 3 show that the coefficient of the interaction term between *controlling climate* and *job demands* is negative and significant at $p < 0.05$, supporting Hypothesis 6. Figures 3 and 4 illustrate these effects. It is worth noting that controlling climate strongly moderates the effect of job demands on overall innovation, such that the negative effect of job demands disappears at a relatively low level of controlling climate and turns positive at higher levels of controlling climate.

Hypotheses 7 and 8 suggest that an innovative climate can serve as an important type of job resource that alleviates the negative effects of executive job demands on both overall innovation and share of exploratory innovations. Results from model 6 in Tables 2 and 3 show that the interaction term between *innovative climate* and *executive job demands* is

FIGURE 2
Effects of Executive Job Demands on Share of Exploratory Innovation at Different Levels of TMT Variety

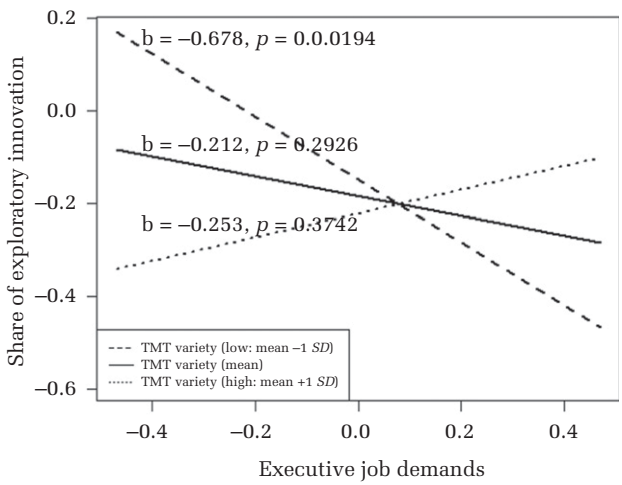


FIGURE 4
Effects of Executive Job Demands on Share of Exploratory Innovation at Different Levels of Controlling Climate

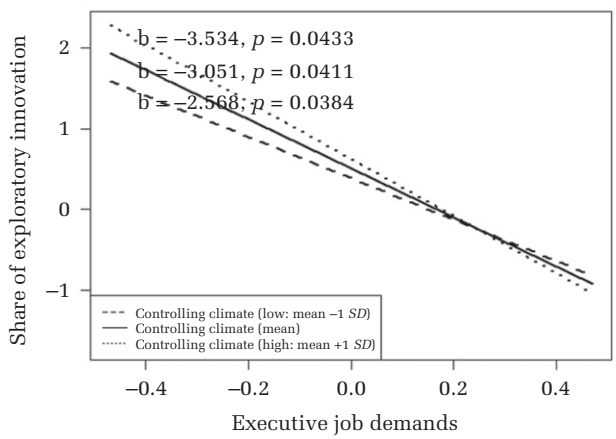


FIGURE 5
Effects of Executive Job Demands on Overall Innovation at Different Levels of Employee Education

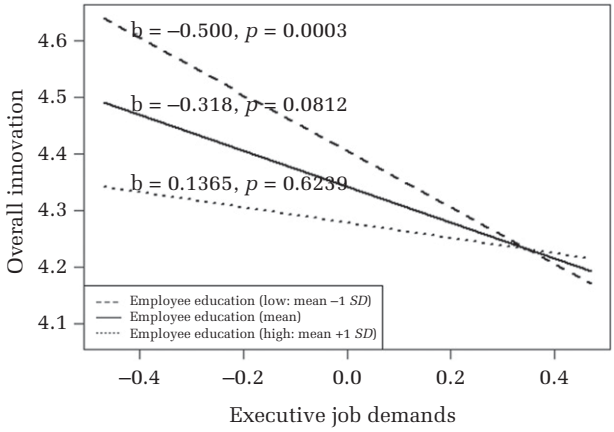
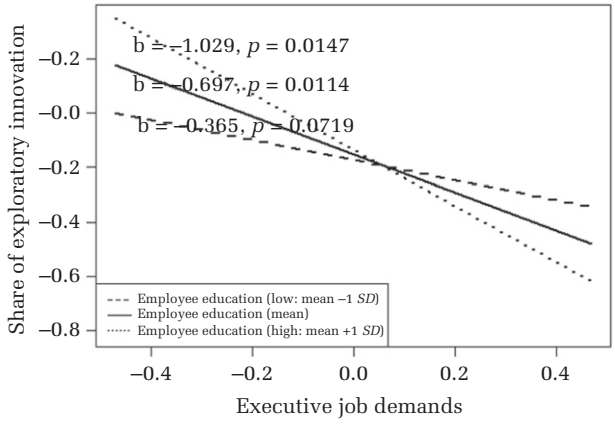


FIGURE 6
Effects of Executive Job Demands on Share of Exploratory Innovation at Different Levels of Employee Education



insignificant, providing no support for Hypothesis 7 or Hypothesis 8.

Findings from model 6 in Table 2 show that the coefficient of the interaction term between *employees' education* and *executive job demands* is significantly positive at $p < 0.10$. This provides marginal support for Hypothesis 9, which predicts that employees' education weakens the negative effect of executive job demands on overall innovation. Results from model 6 in Table 3 show that coefficient of the interaction term between *employees' education* and *executive job demands* is significantly negative at $p < 0.05$. This suggests that employees' education significantly exacerbates the negative effect of executive job demands on the share of exploratory innovations, supporting Hypothesis 10. Figures 5 and 6 illustrate the moderating effects of employees' education.

In sum, five of our 10 hypotheses (i.e., Hypothesis 1, Hypothesis 4, Hypothesis 5, Hypothesis 6, and Hypothesis 10) were supported at $p < 0.05$, and three hypotheses (i.e., Hypothesis 2, Hypothesis 3, and Hypothesis 9) were marginally supported at $p < 0.10$, but the two hypotheses related to the moderating effect of innovative climate (i.e., Hypothesis 7 and Hypothesis 8) were not supported by our findings. Tables 2 and 3 further confirm these findings by showing that the R^2 of our model increased significantly whenever a significant interaction term was added to the model. In addition, the R^2 increased significantly from the model with controls only to our complete model, confirming that including the hypothesized effects improved the overall model fit significantly.

Robustness Analysis

We conducted additional analyses to evaluate the robustness of our findings (all available upon request). In one analysis, we used the number of new patents granted to each firm within two years of our survey as an objective measure of overall innovation. We also used the percentage of sales generated by new products (versus existing products) as an objective measure of the share of exploratory innovations (e.g., Ernst, Hoyer, & Rübsaamen, 2010). We used Poisson regressions to analyze the number of new patents granted to a firm and OLS regressions to analyze the percentage of sales (logarithm) from new products. The effect of executive job demands on the number of new patents was negative and significant at $p < 0.01$, and the effect on new product sales was negative and significant at $p < 0.05$, providing further support for our theoretical expectations.

We also conducted an additional analysis in which we used the average rating of multiple informants (i.e., the CEO and the administrative director) to measure innovation outcomes. Results from this analysis provided consistent support for the hypothesized effects of executive job demands on both overall innovation and share of exploratory innovations.

In an additional analysis, we tested whether the effect of executive job demands on exploratory

innovations is significantly more negative than its effect on exploitative innovations and found consistent support for our theory. We further evaluated the impact of possible omitted variables by calculating the impact threshold for a confounding variable (i.e., impact threshold of a confounding variable) (Busenbark, Lange, & Certo, 2017; Frank, 2000; Hubbard, Christensen, & Graffin, 2017; Oliver, Krause, Busenbark, & Kalm, 2018), but found no evidence of concern.

Additional Analysis

In an additional analysis, we included the squared term of executive job demands in our model but found no support for this nonlinear specification. While studies on job demands on lower-level employees have often reported an inverted U–shaped relationship between job demands and performance (see the review by Janssen, 2001), top executives on average experience substantially higher levels of job demands than very busy employees or middle-level managers. Given these considerations, we theorize that executive job demands have a linear and negative effect on innovation, and our findings confirmed that the hypothesized linear relationship is appropriate.

We conducted a separate analysis to further understand the effect of each aspect of executive job demands. Following Hambrick et al. (2005), we combined our measures of industry dynamism, hostile buyers and suppliers, and hostile competitors into an index of task challenge and then regressed overall innovation and share of exploration innovations on task challenge, performance challenge, and executive aspirations (i.e., the three aspects of executive job demands suggested by Hambrick et al., 2005), together with controls. The results show that task challenge has significantly more negative effects than other aspects of job demands on both overall innovation and share of exploratory innovations. This suggests that task challenge represents the most influential aspect of executive job demands. We speculate that industry dynamism, hostile buyers and suppliers, and hostile competitors perhaps place more urgent and frequent demands on top executives than poor performance or a CEO's high aspirations. Because these are ex post speculations, future research should more systematically examine why different indicators of executive job demands may have differential effects on their strategic decisions.

In another analysis, we found a significant and negative effect of executive job demands on divergent organizational change, measured by a 5-item scale adapted from Battilana and Casciaro (2012) (α was 0.78). Our findings imply that executive job demands may have a general effect of reducing top executives' risk-taking tendency (Bromiley, Rau, & Zhang, 2017), providing support for a major mechanism in our theory.

DISCUSSION

Our theory and supportive findings call for more attention to be paid to the important role of top executives' job environment in influencing firms' overall innovation and share of exploratory versus exploitative innovations. Our findings show that executive job demands, a key attribute of top executives' objective job environment, significantly and negatively affect a firm's overall innovation and share of exploratory innovations. In addition, the negative effect of executive job demands on overall innovation is significantly weakened by variety in executives' gender, age, and tenure, a controlling climate, and employees' education. Moreover, the negative effect of executive job demands on a firm's share of exploratory (versus exploitative) innovations is significantly alleviated by variety in executives' gender, age, and tenure but significantly exacerbated by a controlling climate and employees' education. An innovative climate, however, has no significant moderating effect on a firm's overall innovation or share of exploratory innovations. Overall, our findings provide support for our theoretical expectations about the important role of executive job demands in influencing innovation outcomes.

Our study makes important contributions to research on innovation. Although interest in the roles of top executives in influencing innovation and the balance between exploratory and exploitative innovations has increased, extant research has largely focused on top executives' cognition or individual characteristics. Despite evidence from psychological research on the important role of job environment in influencing creativity and leadership (Demerouti et al., 2001; Schaufeli & Bakker, 2004), little theoretical or empirical work has examined how top executives' job environment affects their firms' innovation. In explaining how executive job demands—a fundamental characteristic of top executives' objective job environment—negatively affect firms' overall innovation and share of exploratory (versus exploitative) innovations, our study highlights an important and novel determinant of firm innovation.

In addition, our study makes important contributions to strategic leadership research on executive job demands. Although executive job demands is a key construct in upper echelons theory (Hambrick, 2007; Hambrick et al., 2005), theoretical work has yet to examine its effects on firms' overall innovation or share of exploratory innovations, which are two central issues in strategic management. In addition, research has not incorporated recent developments in psychology to consider the moderating effects of job support and job resources. In explaining that the effect of executive job demands is contingent on TMTs' cognitive capabilities, a controlling climate that reduces demands on executives' cognitive resources, and organizational resources (i.e., an innovative climate and employees' education) that compensate for their lack of cognitive resources, this study significantly improves our understanding of the boundary conditions of executive job demands theory. Furthermore, this study offers the first piece of direct evidence of the validity of executive job demands theory, making an important empirical contribution.

Moreover, our theory and findings make important contributions to psychological research on job demands. Although thousands of studies have examined the effects of job demands on employees and managers (see review by Parker, Morgeson, & Johns, 2017), to our knowledge, our study is one of the first to systematically examine executive job demands, thereby expanding the domain of research on job demands to include the most influential group of individuals in organizations. The moderators included in our theoretical framework are also relatively novel to the job demands literature. In addition, our empirical approach suggests that not all top executives are adequately informed about all causal indicators of job demands. It is thus important to use responses from multiple well-informed top executives in measuring these causal indicators.

This study also has important implications for practice. Specifically, our study suggests that executives need to be very aware of the negative consequences of their job demands on firms' innovation, especially exploratory innovation. Our theory and findings related to the moderating effects of variety in executives' gender, age, and tenure, employees' education, and organizational climate further suggest practical ways to help top executives overcome the challenges associated with working under high job demands.

Our study had limitations that present opportunities for future research. Our one-wave survey design limited our ability to make a strong causal inference about the relationships of interest. Our findings also provided no support for the moderating effect of innovative climate on overall innovation or share of exploratory innovations. In additional analyses without controls for TMT gender mix, age, and tenure, we found that the moderating effect of innovation climate on share of exploratory innovations was marginally significant at $p < 0.10$, but the moderating effect of employees' education became insignificant. While our findings for other hypotheses were robust to the inclusion or exclusion of controls, we would interpret our findings related to the two moderating effects above with caution. Future studies can help explain why evidence on these moderating effects was not entirely consistent in different models. In addition, our sample included small and medium-sized firms in China. Future research can help us assess the generalizability of our findings to other countries. For example, our theoretical arguments are likely to receive stronger (weaker) support in countries that have weaker (stronger) institutional environments than China (Crossland & Hambrick, 2007; Olie, van Iterson, & Simsek, 2012).

While our study focused on job demands on all top executives, future studies can build on the emerging stream of research on CEO–TMT interfaces (Bromiley & Rau, 2016; Georgakakis, Heyden, Oehmichen, & Ekanayake, 2019; Simsek et al., 2018) to examine how a CEO's relationship with other top executives may influence the effects of executive job demands. For example, the CEO's dependence on other top executives for information may reduce the job demands on the CEO, while other executives' dependence on the CEO for permission to pursue initiatives can increase it (Simsek et al., 2018). National differences in culture can also have major impacts on the dynamics within TMTs (Olie et al., 2012) and lead to different effects of executive job demands. For instance, the Chinese culture of maintaining social harmony may discourage the expression of different opinions by top executives (Qian et al., 2103), while a culture with a high level of individualism may encourage it. Our study shows that TMT variety in gender, age, and tenure has no significant main effect on innovation (in part due to the influence of the Chinese culture) but still has a significant moderating effect, suggesting that executives under higher job demands are especially likely to express their views based on their unique backgrounds, even in the Chinese culture. The interaction effect between variety in executives' gender, age, and tenure and job demands is likely to be even

stronger in a culture with a higher level of individualism. In general, our study highlights that the effect of executive job demands is often contingent on other factors. Exploring how factors at the CEO–TMT interface (e.g., types of dependence between the CEO and other executives and harmony-oriented social norms) may influence the effect of executive job demands seems to be a promising direction for future research.

While Hambrick et al. (2005) identified a number of opportunities to advance research on executive job demands, there are also rich opportunities to examine how executive job demands may influence other types of strategic decisions made by top executives. For example, job demands on employees have been found to be associated with aggression (e.g., Demir, Rodwell, & Flower, 2014). There would be value in research that examines how executive job demands may influence firms' competitive behaviors (Chen & Miller, 2015). Moreover, our findings provide some evidence that top executives under high job demands are less likely to take risks. Because risk-taking decisions are a fundamental issue in strategic management (Bromiley et al., 2017), it will be important for future studies to examine how executive job demands may influence other types of risk-taking decisions, such as mergers and acquisitions and international diversification. In general, incorporating more recent developments from psychological research on job environment and extending the present study to explore other strategic consequences of executive job demands seems to offer promising directions for future research.

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APPENDIX A: ADDITIONAL FINDINGS

To minimize common source variance, we asked different top executives to provide information about our dependent and independent variables (see Table A1 for a summary). We further conducted three analyses to evaluate the degree of common method bias in our study (detailed results are available upon request). First, we included the dependent variable (i.e., innovation measured by 12 items) and the independent variable (i.e., executive job demand measured by five factors with 33 items) in a Harman's single-factor test. The single unrotated factor only accounts for 20.96% of the total variance, far from the majority that is required to show a concerning level of common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In addition, a 6-factor rather than a single-factor structure emerged and accounted for 62.94% of the total variance, again showing no evidence of a concerning level of common method bias (Podsakoff et al., 2003).

Second, a confirmatory factor analysis (CFA) revealed that the 6-factor model (CFI = 0.94, SRMR = 0.06, RMSEA = 0.07) fit the data significantly better than the null model and other collapsed models. The square root of the average variance extracted (AVE) for a given latent factor ranged between 0.69 and 0.93, which is significantly greater than the correlations with other latent factors. These results provided support for the convergent and discriminant validity of all six constructs (Anderson & Gerbing, 1988), suggesting that "the probability of common method variance occurring is minimized" (Iverson & Maguire, 2000: 822).

Third, we conducted a full collinearity test (Kock & Lynn, 2012) to examine the variance inflation

TABLE A1
Informants and Inter-rater Reliability for Study Variables

Variable name	Variable type	Informant for the primary analysis	Additional informant	ICC1
Innovation	Dependent	CEO or vice CEO	Administrative director	0.23
Hostile suppliers and buyers	Independent	Administrative director	CEO or vice CEO	0.23
Hostile competitors	Independent	Administrative director	CEO or vice CEO	0.14
Environment dynamism	Independent	Administrative director	Production director	0.12
Performance challenge	Independent	Archival records from financial director		
CEO need for achievement[a]	Independent	CEO or vice CEO		
Employees' education	Moderator/control	Archival records from HR director		
Innovative climate	Moderator/control	HR director	Production director	0.30
Controlling climate	Moderator/control	HR director	Production director	0.30
TMT gender, age, and tenure	Moderator/control	Each top executive		
Fear of imitation	Control	Administrative director	CEO or vice CEO	0.17
Industry innovation	Control	Archival records from financial director		
Ties to government	Control	Four government officials		0.30
Firm age	Control	Archival records from CEO or vice CEO		
Firm size	Control	Archival records from HR director		
R&D	Control	Archival records from financial director		
Firm ownership	Control	Archival records from CEO or vice CEO		
CEO title	Control	Archival records from CEO or vice CEO		

[a] We did not ask another executive to assess CEO need for achievement because psychological studies typically rely on self-assessments to measure need for achievement (see review by Spangler, 1992). In an additional analysis, we excluded CEO need for achievement from our measure of job demands and still obtained consistent support for our theory.

TABLE A2
Summary Statistics for Executive Job Demands and Its Causal Indicators

Variable	Mean	*SD*	1	2	3	4	5
1. Job demands index	0.00	0.47					
2. Industry dynamism	−0.02	1.13	0.43*				
3. Hostile suppliers and buyers	−0.06	0.95	0.45*	−0.19*			
4. Hostile competitors	0.03	1.00	0.61*	−0.03	0.35*		
5. Performance challenge	0.01	0.93	0.40*	−0.04	0.04	0.08	
6. Need for achievement	0.05	1.00	0.44*	0.10	−0.08	0.05	−0.07

Note: $n = 243$.
* $p < .05$

TABLE A3
Confirmatory Factor Analyses for Overall Innovation (One Factor) and Exploratory and Exploitative Innovations (Two Factors) ($n = 243$)

Models	χ^2	df	RMSEA	SRMR	GFI	AGFI	CFI	IFI	NFI	TLI	PGFI	PNFI
One factor	232.55	50	0.099	0.044	0.90	0.85	0.94	0.94	0.93	0.92	0.58	0.70
Two factors	167.22	49	0.081	0.038	0.93	0.89	0.96	0.96	0.95	0.95	0.58	0.70

factors (VIFs) for the latent variables that correspond to the dependent and independent variables. Using the WarpPLS software developed by Kock (2019), we found that the VIFs for the latent variables ranged from 1.02 to 1.46, which was much lower than the threshold of 3.30 that would suggest a concerning level of common method bias. Findings from these analyses thus showed that common method bias was not a concern in our study.

While we have reported evidence for the validity of our measure of job demands and the inter-rater reliability of these measures, we conducted further analyses to assess the degree to which different top executives' ratings of job demands were affected by their personal differences. Two-sample *t*-tests revealed no significant differences in the ratings of two top executives from the same firm on any indicators of job demands. This, together with the satisfactory

TABLE A4
Simple Slopes in the Analysis of Overall Innovation ($n = 243$)

Moderators	Simple slope	Standard error	*T*-value	*P*-value
TMT variety				
Low (mean −1 *SD*)	−0.6866	0.1948	−3.5242	0.0005
Mean (mean)	−0.5075	0.1360	−3.7308	0.0002
High (mean +1 *SD*)	−0.3284	0.1917	−1.7131	0.0882
Controlling climate				
Low (mean −1 *SD*)	0.8546	0.8375	1.0205	0.3087
Mean (mean)	1.1505	1.0090	1.1403	0.2555
High (mean +1 *SD*)	1.4465	1.1811	1.2247	0.2221
Employees' education				
Low (mean −1 *SD*)	−0.4998	0.1357	−3.6819	0.0003
Mean (mean)	−0.3181	0.1816	−1.7521	0.0812
High (mean +1 *SD*)	−0.1365	0.2780	−0.4910	0.6239

Notes: Table A4 reports simple slopes related to each moderating variable. Table A4 shows that the effect of job demands on overall innovation remains negative at all levels of TMT variety, although it becomes less negative and only marginally significant at a relatively high level of TMT variety. In addition, the effect of job demands becomes positive even at a relatively low level of controlling climate, but the positive effect is not significant. This suggests that controlling culture is a strong moderator that can totally eliminate the negative effect of job demands. Moreover, the effect of job demands remains negative at all levels of employee education but becomes less negative and insignificant at higher levels of it, highlighting the magnitude of this moderating effect.

TABLE A5
Simple Slopes in the Analysis of Share of Exploratory Innovations (n = 243)

Moderators	Simple slope	Standard error	*T*-value	*P*-value
TMT variety				
Low (mean −1 *SD*)	−0.6776	0.2875	−2.3572	0.0194
Mean (mean)	−0.2124	0.2012	−1.0553	0.2926
High (mean +1 *SD*)	0.2529	0.2839	0.8907	0.3742
Controlling climate				
Low (mean −1 *SD*)	−2.5680	1.2322	−2.0841	0.0384
Mean (mean)	−3.0511	1.4845	−2.0553	0.0411
High (mean +1 *SD*)	−3.5342	1.7376	−2.0339	0.0433
Employees' education				
Low (mean −1 *SD*)	−0.3645	0.2014	−1.8094	0.0719
Mean (mean)	−0.6967	0.2730	−2.5522	0.0114
High (mean +1 *SD*)	−1.0290	0.4180	−2.4619	0.0147

Notes: Table A5 further reports simple slopes related to each moderating variable. Table A5 shows that the negative effect of job demands on share of exploratory innovations becomes insignificant at the average level of TMT variety and turns positive at a relatively high level, highlighting the large magnitude of this moderating effect. The effect of job demands remains negative at all levels of controlling climate but becomes less negative at lower levels of it. The negative effect of job demands becomes weaker and only marginally significant when the level of employee education is relatively low.

level of inter-rater reliability that we reported earlier, suggests that the two most informed top executives that we chose from each firm did not provide significantly different ratings on any indicators of job demands. In addition, we regressed each indicator of job demands on all available attributes of a respondent, including gender, age, tenure, and education, together with a set of controls at the firm and industry levels (i.e., firm size, firm age, firm performance, ownership type, industry of affiliation, and industry innovation) but did not find any significant effects of these individual characteristics on any indicators of job demands (except that older administrative directors tend to report a lower level of industry dynamism). These findings suggest that common attributes of top executives are generally

FIGURE A1
Estimated Power at Different Levels of R^2

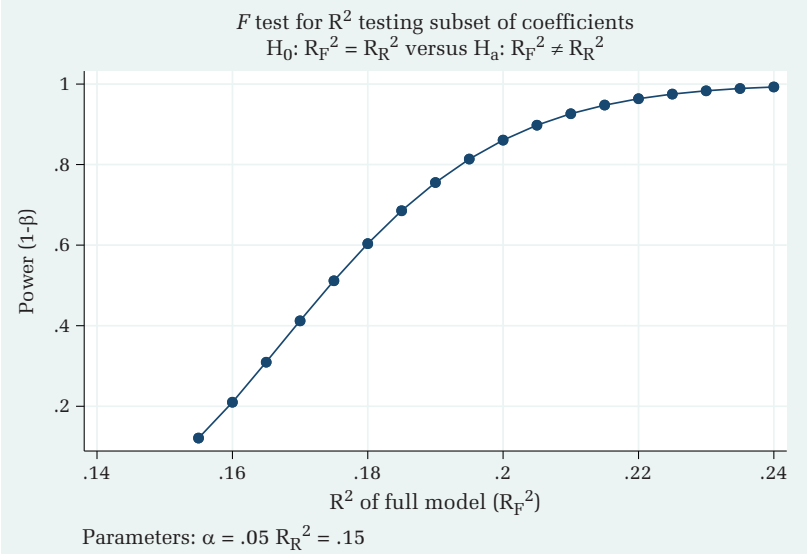
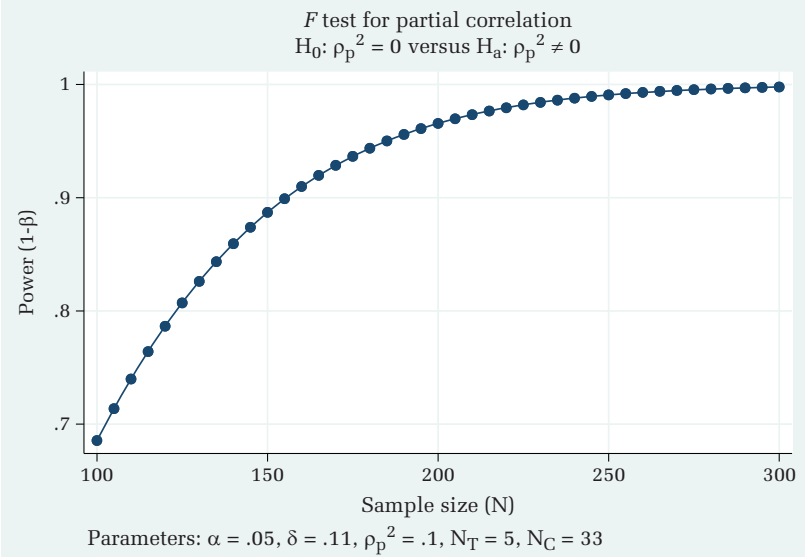


FIGURE A2
Estimated Power of a Significant Effect at Different Sample Sizes



not significantly associated with their ratings of job demands.

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