Full length article

The military imprint: The effect of executives' military experience on firm pollution and environmental innovation

Zhe Zhang [a,1], Bingkun Zhang [a,b,*,1], Ming Jia [c]

[a] School of Management, Xi'an Jiaotong University, China
[b] Faculty of Business and Economics, University of Hong Kong, Hong Kong
[c] School of Management, Northwestern Polytechnical University, China

ARTICLE INFO

ABSTRACT

This study focuses on military experienced executives (CEO and chairman) and their effect on two types of firm environmental strategy: firm pollution and environmental innovation. From the perspective of imprinting theory, we find that executives with military imprint, which, so we argue, instills a sense of following rules and stewardship for the collective, negatively relate to firm pollution and positively relate to firm environmental innovation. The strength of military imprint at its formation is shaped by whether focal executives had a military officer rank. In addition, working in an environment with strong pro-military culture sustains and even strengthens the military imprint. Analyses of data from 6,664 firm-year observations of heavily polluting industries from Chinese listed firms between 2013 and 2017 largely support our hypotheses (see Table 4 for overview of various tests). Overall, our efforts of extending imprinting theory to leadership literature suggest that the imprinting effect of military experience persists in executives' decision-making processes. Furthermore, this study contributes to imprinting research by emphasizing the importance of considering imprint formation and imprint persistence.

Introduction

Recent empirical research demonstrates that military experienced executives (CEO and chairman) have a profound influence on corporate behaviors in the financial sphere, such that military experienced executives less likely participate in alleged corporate fraud (Benmelech & Frydman, 2015), financial misconduct (Koch-Bayram & Wernicke, 2018), and tax avoidance (Law & Mills, 2017). However, as firms are increasingly compelled to engage in societal contributions beyond mere regulatory compliance (Filatotchev & Nakajima, 2014; Nason, Bacq, & Gras, 2018), the implication of military experienced executives for firm behaviors and outcomes has yet to be extended to corporate environmentalism literature (Wang, Wijen, & Heugens, 2018). Filling this gap is important because military experienced executives leading their firms not to conduct illegitimate activities in the financial sphere does not necessarily mean that they are leading their firms to engage in exemplary activities in the context of corporate environmentalism. The former encompasses corporate actions that are deemed illegitimate from a legal and regulatory viewpoint (Koch-Bayram & Wernicke, 2018), whereas the latter refers to volun-

tary corporate actions designed to improve environmental condition (Mackey, Mackey, & Barney, 2007).

In recent years, environmental pollution has become an increasingly serious issue and has caused worldwide concern, especially in China, where rapid economic growth comes at a price of ecological deterioration (Kock, Santaló, & Diestre, 2012; Wong, Miao, Cui, & Tang, 2018). Some firms' unethical behaviors make them important pollution contributors, such as violating an environmental regulation by inappropriately releasing toxic materials and emissions (Bowen, Bansal, & Slawinski, 2018; Meng, Zeng, & Tam, 2013). By contrast, other firms engage in environmental innovation, which is defined as the development of products, processes, and services aimed at reducing environmental harm by using new methods for treating emissions, recycling or reusing waste, and finding cleaner energy sources (Berrone, Fosfuri, Gelabert, & Gomez-Mejia, 2013; Brunnermeier & Cohen, 2003). Given that environmental deterioration negatively affects society, firms in heavily polluting industries urgently need to improve their environmental performance. Therefore, in this study, we extend the research on military experienced executives to corporate environmentalism literature and explore whether military experi-

---

enced executives affect firm environmental strategies. If so, how and when?

Drawing on insights of imprinting theory (Marquis & Tilcsik, 2013; Simsek, Fox, & Heavey, 2015), we investigate how an executive's (CEO's and chairman's) military imprint simultaneously affects a firm's participation in firm pollution and environmental innovation. Studying the negative and positive components of firm environmental strategies allows scholars to unveil new insights because a firm can engage in good deeds and bad deeds at the same time, yet the two are conceptually distinct and subject to different dynamics (Fu, Tang, & Chen, 2020; Lange & Washburn, 2012; Mattingly & Berman, 2006). Specifically, we argue that military experience imprints individuals with the value of willingness to follow rules; thus, military experienced executives are likely to follow environmental regulations and then less likely to participate in firm pollution. Furthermore, we argue that such military experience leaves individuals with an imprint of stewardship for the collective. This imprint leads military experienced executives to behave in ways that serve the long-term welfare of society and makes them more likely to participate in environmental innovation.

We further theorize about the strength of imprint to investigate when military experienced executives affect firm environmental strategies (Wang, Du, & Marquis, 2019). Imprinting literature suggests that imprint formation is not necessarily the same among individuals (Simsek et al., 2015; Wang et al., 2019). In addition, exposure to new environments can affect the original imprint (Marquis & Qiao, 2018; Tilcsik, 2014). Accordingly, we divide the strength of military imprint into two types: the strengths of imprint at its formation and at its persistence. Specifically, at the stage of imprint formation, individuals with a military officer rank experience high levels of socialization and thus form a strong military imprint. At the stage of imprint persistence, the persistence of the imprint is influenced by the characteristics of the environment in which executives are currently working (Tilcsik, 2014). Working in a strong pro-military culture environment brings the military imprint to the fore and thus strengthens the imprint. Our theoretical predictions are generally supported by the results of statistical analyses using data from 6664 firm-year observations of heavily polluting industries from Chinese listed firms during 2013–2017.

This study makes several theoretical contributions. First, we contribute to imprinting research by emphasizing the importance of considering imprint formation and imprint persistence. Although previous imprinting research tends to assume that an imprint has a uniform effect (Marquis & Tilcsik, 2013), our results suggest that the extent of socialization at the stage of imprint formation and characteristics of working environmental at the stage of imprint persistence create a variation in the strength of imprint. Second, by demonstrating the influence of military experienced executives on firm pollution and environmental innovation, we extend the research of military experienced executives to corporate environmentalism literature and thus enrich the literature related to the corporate outcomes of military experienced executives (Benmelech & Frydman, 2015; Koch-Bayram & Wernicke, 2018). Third, we enrich the leadership literature by introducing the insight of imprinting theory. Although military experience occurred decades before individuals entered the corporate elite, our results suggest that the imprinting effect of military experience is not easily shed, but is inherent and persists in executives' decision-making processes. Finally, we advance the research on the antecedents of the two environmental strategies and thus enrich the understanding of why firms vary in their pollution activities and environmental innovation (Berrone et al., 2013; Zhang, Ren, Chen, Li, & Yin, 2018).

Theoretical background

Imprinting theory

Stinchcombe (1965) first introduced the notion of imprinting to organizational theory, stimulating a line of research on how founding conditions affect subsequent organizational outcomes (Johnson, 2007). Since then, the concept of imprinting has been applied across different levels, including organizational collectives, single organizations, organizational building blocks, and individuals (Marquis & Tilcsik, 2013). Marquis and Tilcsik (2013, p.201), in their review of imprinting theory, defined imprinting as "a process whereby, during a brief period of susceptibility, a focal entity develops characteristics that reflect prominent features of the environment, and these characteristics continue to persist despite significant environmental changes in subsequent periods."

For individuals, sensitive periods typically occur when they are experiencing role transitions or when they are forming their worldviews, values, and beliefs, rather than simply "early" periods (Higgins, 2006; Kish-Gephart & Campbell, 2015). During this brief sensitive period, highly motived to reduce uncertainty about expectations and requirements in their new roles, the focal entities are not only open to learning new skills but also receptive to environmental influences and tend to achieve congruence with their new surroundings, resulting in an imprinting effect that reflects the characteristics of the corresponding environment (Briscoe & Kellogg, 2011; Tilcsik, 2014).

Nevertheless, most existing imprinting studies tend to assume that an imprint has a uniform effect and are silent on considering the process of imprint formation and imprint persistence (e.g., Marquis & Qiao, 2018; Snihur & Zott, 2020; Tilcsik, 2014; Wang et al., 2019). On the one hand, most prior scholars took imprint formation for granted. As a result, knowledge about why individuals react differently to the identical environmental and thus form different strengths of imprint is limited (Simsek et al., 2015). On the other hand, the definition of imprinting emphasizes persistence rather than permanence or irreversibility (Marquis & Tilcsik, 2013), thus implying that some imprints may strengthen or fade over time. In this regard, Marquis and Tilcsik (2013), in a review paper of imprinting theory, called for future scholars to pay more attention on imprinting dynamics and encouraged them to explore how imprints amplify or decay under certain conditions. To answer this call and fill the research gaps mentioned above, we divide the strength of military imprint into two types: the strength of imprint at its formation and at its persistence, and investigate factors that affect each of them.

Hypothesis development

Military experienced executives and firm pollution

According to imprinting theory (Marquis & Tilcsik, 2013; Simsek et al., 2015), we suggest that a relatively complete understanding of military imprint can be gained by exploring it through imprint formation and imprint persistence. In the following part, we attempt to explain how military imprint forms and persists, and how military imprint affects corporate executives' decision making about firm environmental strategies.

First, at the stage of imprint formation, military training consists of several socialization processes that provide an ideal environment where a military imprint can form (Akerlof & Kranton, 2005; Arkin & Dobrofsky, 1978). Most servicepersons join the army in their early twenties, which is a sensitive period of transition in one's life. During this period, individuals form their worldviews and are highly susceptible to environmental influences (Marquis & Tilcsik, 2013). In addition, to maintain internal coherence and loyalty to the military, every new recruit undergoes intensive socialization to learn military norms and values (Higgins, 2006). During training programs, expectations for specific behaviors and explicit norms are made explicitly. Given that the military significantly esteems following commands and stewardship for the collective, recruits' original status and habits are broken down, and a value system that emphasizes obedience to rules and serving the long-term welfare of society will be instilled subsequently (Duffy, 2006; Koch-Bayram & Wernicke, 2018). Moreover, the military

has set up an incentive system to reward those who fulfill the expectations and penalize those who do not (Jackson, Thoemmes, Jonkmann, Lüdtke, & Trautwein, 2012). All these socialization processes lead to changes in daily behavior and personality, that, over time, are thought to leave a military imprint, which comprises obedience to rules and stewardship for the collective, on individuals (Marquis & Tilcsik, 2013; Simsek et al., 2015).

Second, at the stage of imprint persistence, such a military imprint sustains despite significant environmental changes in subsequent periods (Marquis & Tilcsik, 2013). Prior research suggests that even with subsequent environmental changes, individuals continue to carry with them the orientations, beliefs, and behaviors adopted during the period of imprint formation (Azoulay, Liu, & Stuart, 2011; Higgins, 2006; McEvily, Jaffee, & Tortoriello, 2012). For instance, Lowell McAdam, the CEO of Verizon, talked about his service in the U.S Navy: "The things you learn in the service will stay with you your whole life" (Asfar, 2009). Generally, the military imprint exhibits inertia and persists over time; hence, it can be brought into the business area by people with military experience (Marquis & Tilcsik, 2013; Simsek et al., 2015).

In our context, such a military imprint, so we argue, will affect executives' decision making about firm environmental strategies. Moreover, we suggest that a relatively complete understanding of the effect of military experienced executives on firm environmental strategies can be gained by discussing military experienced executives' two imprints that their military experience leaves: following rules and stewardship for the collective (Benmelech & Frydman, 2015; Duffy, 2006; Koch-Bayram & Wernicke, 2018). Here, stewardship entails placing the "long-term best interests of a group ahead of personal goal that serve an individual's self-interests" (Hernandez, 2008, p.122; Hernandez, 2012). Specifically, we argue that the imprint of following rules can explain why military experienced executives less likely participate in pollution, whereas the imprint of stewardship for the collective can inform why they likely engage in environmental innovation. In the following part, we discuss how the imprint of following rules motivates military experienced executives to follow environmental regulations and then makes them less likely participate in firm pollution.

Military servicepersons are trained to follow commands (Koch-Bayram & Wernicke, 2018; Duffy, 2006). Military norms and beliefs involve the tenet "obey the rules of the organization and follow orders given in the chain of command" (Akerlof & Kranton, 2005, p.17). Consistent with this logic, many empirical studies demonstrate that as the military strongly emphasizes the obedience of its personnel, executives with military experience are imprinted with the value of following rules; and such obedience, in turn, makes their firm less likely to participate in financial misconduct (Koch-Bayram & Wernicke, 2018), less likely to be involved in corporate fraudulent activity (Benmelech & Frydman, 2015), and pursue fewer strategies to avoid taxes (Law & Mills, 2017). Thus, military experienced executives, imprinted with values of willingness to follow commands, exhibit a characteristic that weighs more on following environmental regulations.

In this regard, firm pollution activities encompass firm environmental actions that are deemed illegitimate from a legal and regulation viewpoint, such as violating an environmental regulation by inappropriately disposing of hazardous materials and pollutant emission (Wong et al., 2018). Thus, military experienced executives, who are likely to comply with environmental regulations, will less likely participate in firm pollution. Formally, we propose the following:

Hypothesis 1 (*H1*). There is a negative relationship between military experienced executives (CEO and chairman) and firm pollution.

Military experienced executives and environmental innovation

Prior studies find that firms not only "do good deeds" but also "do bad deeds," sometimes simultaneously (Fombrun, Gardberg, & Barnett, 2000; Mishina, Dykes, Block, & Pollock, 2010; Muller & Kräussl, 2011). In addition, researchers increasingly come to consider good deeds (e.g., environmental responsible activities) and bad deeds (e.g., environmental irresponsible activities) as conceptually distinct phenomena, with different implications for firms (Fu, Tang, & Chen, 2020; Godfrey, Merrill, & Hansen, 2009; Strike, Gao, & Bansal, 2006). Thus, examining how military experienced executives affect negative and positive components of firm environmental strategies can lead to a thorough understanding of the effect of military imprint on firm environmental strategies. In our study, as military experienced executives' imprint of following rules will lead them to less likely participate in firm pollution, we expect that military experienced executives' imprint of stewardship for the collective will lead them to engage in environmental innovation for two reasons. Stewardship is defined as "the extent to which an individual willingly subjugates his or her personal interest to act in protection of others'[collective's] long-term welfare" (Hernandez, 2012, p.174).

First, the imprint of stewardship for the present collective motivates military experienced executives to consider the wellbeing of society by improving the environment at the present. The military emphasizes duty, dedication, and self-sacrifice; especially through a series of systematic training programs, the military makes servicepersons embrace the philosophy "service before self" (Cao, Sun, & Yuan, 2019; Duffy, 2006; Elder, 1986; Xie & Hao, 2017). Thus, executives with military imprint likely demonstrate care about the society and the common good, intending to bring a positive effect on the society and natural environmental (Ferdig, 2007). An example of such concern is adopting innovative technology solutions that facilitate solving environmental issues, such as developing new methods of treating greenhouse gas and wastewater emissions, exploring cleaner energy sources, and recycling or reusing waste (Berrone et al., 2013; Brunnermeier & Cohen, 2003).

Second, the imprint of stewardship for the future collective motivates military experienced executives to favor long-term orientation and protect the future environment. Nowadays, many firms' environmental misconducts become sources of ecological deterioration, which pose risks for sustainable development (Wong et al., 2018). However, military experienced executives highly esteem behaving in ways that serve the long-term welfare of society (Xie & Hao, 2017). Thus, military experienced executives likely show a long-term view in their daily business activities by considering future organizational continuance and growth (Ferdig, 2007; Wong, Bliese, & McGurk, 2003). This increases the likelihood that military experienced executives will participate in environmental innovation.

Fundamentally, compared with nonmilitary experienced executives, the stewardship for the collective imprinted by military experience—consisting of care about the welfare of society and long-term orientation—is likely to motivate military experienced executives to bring a positive impact on the natural environment and thus makes them more likely to engage in environmental innovation. Accordingly, we propose the following:

Hypothesis 2 (*H2*). There is a positive relationship between military experienced executives (CEO and chairman) and environmental innovation.

Factors affecting the strengths of military imprint at its formation and at its persistence

The mechanism that underlies H1 and H2 is military imprint. We further argue that the relationship between military experienced executives and firm environmental strategies is contingent on the strength of military imprint. The strength of imprint describes the degree to which imprint affects individual behaviors (Simsek et al., 2015). That is, if the focal executive has a strong military imprint, then its effect will be especially powerful, thereby strengthening the relationship

between military experienced executives and firm environmental strategies. Imprinting literature reveals that the strength of imprint is shaped by (1) individual characteristics at the stage of imprint formation and (2) environmental characteristics at the stage of imprint persistence (Marquis & Qiao, 2018; Marquis & Tilcsik, 2013; Tilcsik, 2014; Wang et al., 2019).

In our context, (1) military officer rank can be a good proxy for military experienced executives' characteristics at the stage of imprint formation and (2) pro-military culture is a good proxy for the characteristics of executives' current working environments. Following prior research (Stadelmann, Portmann, & Eichenberger, 2015), we define pro-military culture environment as a cultural environment in which people and governmental institutions highly respect the military and retired soldiers. Although military officer rank affects the strength of military imprint at its formation, pro-military culture environment shapes the strength of military imprint at its persistence. Accordingly, we explore the moderating effect of military officer rank and pro-military culture on the relationship between military experienced executives and firm environmental strategies in the following section.

Military officer rank and the strength of imprint at its formation

Considering the process of imprint formation, individuals who had military officer rank and those who were regular soldiers likely receive different extents of socialization from the military environment (Marquis & Tilcsik, 2013). If executives had a military officer rank during their military experience, then they would form a stronger military imprint than regular soldiers.

Obtaining a military officer rank means that focal individuals undergo longer and higher-level training than regular soldiers. For servicepersons, it is military training that serves as a catalyst for their change (Jackson et al., 2012). Military training socializes and matures individuals, thereby helping them learn how to behave in the military (Jackson et al., 2012). The military has organized, systematic, and sequential training programs that are designed to help servicepersons acquire hands-on leadership skills (Benmelech & Frydman, 2015; Duffy, 2006; Wansink et al., 2008). Therefore, officers in the military undergo longer and higher-level training than regular soldiers to ensure that they have sufficient command skills and behave as guided by military values and norms (Wong et al., 2003). That is, the socialization effect of the military for individuals with a military officer rank is considerably strong (Marquis & Tilcsik, 2013). In this case, military experience leaves a deep imprint on individuals' routines and habits; hence, the strength of military imprint is strong.

Overall, the imprinting effect of military experience on military experienced executives with a military officer rank is stronger compared with that on those without a military officer rank. Thus, the former are less likely to engage in firm pollution and more likely to participate in environmental innovation. Therefore, we propose the following hypotheses:

Hypothesis 3a (*H3a*). The negative effect of military experienced executives (CEO and chairman) on firm pollution is strengthened when focal executives had a military officer rank during their military experience.

Hypothesis 3b (*H3b*). The positive effect of military experienced executives (CEO and chairman) on environmental innovation is strengthened when focal executives had a military officer rank during their military experience.

Pro-military culture and the strength of imprint at its persistence

Exposure to new environments can affect original imprint; hence, the strength of imprint at its persistence varies depending on the char-

acteristics of the environment in which executives are currently working (Marquis & Qiao, 2018; Wang et al., 2019). It should be noticed that, imprint reflects elements of the original environment; thus, its expression needs stimulation and cues from the current environment (Tilcsik, 2014). Building on imprinting theory, Tilcsik (2014) suggested that imprint's persistence is affected by imprint–environment fit—the compatibility between imprinted values and subsequent environments—as congruent environments sustain the imprint, whereas the imprint decays in incongruent environments. That is, an "imprint can be perfectly suited to one type of context, while clashing irrecoverably with another" (Higgins, 2006, p.4). Examining imprint–environment fit, we argue that working in a strong pro-military culture region can provide cues to further elicit the military imprint, and thus intensify the imprint at its persistence.

When military experienced executives work in an environment with strong pro-military culture, their military identity is highly respected and welcome. As knowledge and practices consistent with military values are highly encouraged and rewarded, military experienced executives are likely to act as though they are within the military (Marquis & Tilcsik, 2013). Moreover, the military imprint and the cultural context are well-matched that military experienced executives can directly apply their military-related habits, routines, and problem-solving schemas to this situation with little adjustment (Tilcsik, 2014). Thus, the match between the military imprint and the environment with strong pro-military culture provides cues to the expression of the military imprint (Lievens et al., 2006; Tett & Burnett, 2003; Tett & Guterman, 2000). In this case, military imprint lingers on and is even strengthened.

By contrast, an environment with weak pro-military culture is generally lowly relevant to military imprint, because the environment offers few cues for the expression of military imprint. When military experienced executives work in such environments, the military imprint may "act as baggage" (Dokko, Wilk, & Rothbard, 2009, p.54; Higgins, 2006). Being exposed to such environments makes military values and beliefs obsolete and counterproductive for military experienced executives (Wang et al., 2019). Then, military imprint-related cognition and behavior patterns need to be updated to suit contemporary demand, finally resulting in military imprint decay (Marquis & Tilcsik, 2013; Simsek et al., 2015).

Overall, the effect of military imprint is strengthened when military experienced executives work in regions where the pro-military culture is strong. As a result, they are less likely to engage in firm pollution and more likely to participate in environmental innovation. Therefore, we propose the following hypotheses:

Hypothesis 4a (*H4a*). The negative effect of military experienced executives (CEO and chairman) on firm pollution is strengthened when focal executives work in a region where the pro-military culture is strong.

Hypothesis 4b (*H4b*). The positive effect of military experienced executives (CEO and chairman) on environmental innovation is strengthened when focal executives work in a region where the pro-military culture is strong.

Fig. 1 illustrates the conceptual framework of this study.

Methodology

Research context

China provides an appropriate setting to investigate the effect of military experienced executives on firm environmental strategies for two reasons. First, China's great disarmament provides a rich set of military experienced executive samples to enable this study. For economic construction, the Chinese government had demobilized approx-
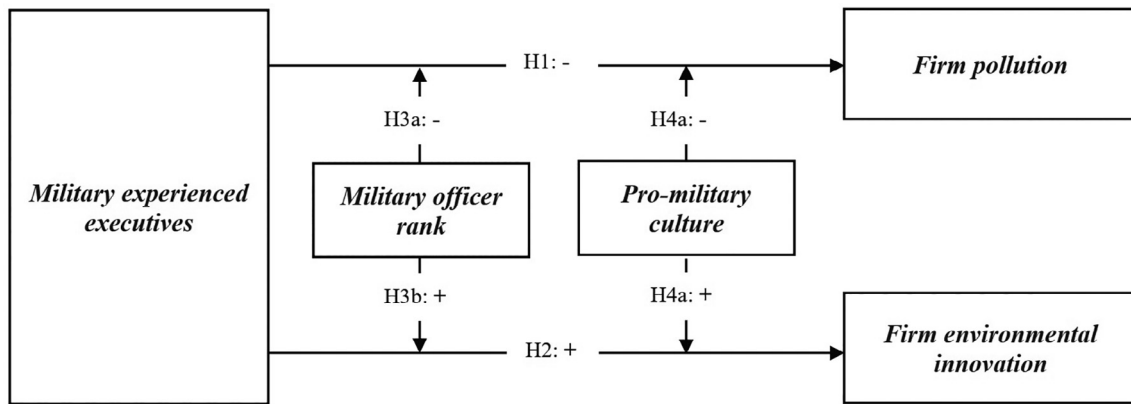
Fig. 1. Conceptual framework.

imately four million servicepersons in the army from the 1980s. The great disarmament caused these soldiers to quit the army and join enterprises or public institutions to start a new career. In addition, the Chinese government has adopted a variety of policies both at central- and local-government levels to provide preferential treatments of retired soldiers in various aspects (e.g., tax benefits and favorable credit) to compensate military persons. Such treatments may help many retired soldiers succeed in business.

Second, environmental issues in China are highly serious and have elicited great concern locally and internationally. The rapid industrialization and economic growth of China have been resulting in severe damage to the environment, such as climate change, natural resource depletion, and severe ecological degradation. In recent years, a growing number of firm incidents that involve natural environmental damage have been reported in China, all of which have caused serious social and environmental consequences, thereby threatening the public health and natural environment. Given that Chinese economy and population continue their upward tendency, their demand and consumption for natural resources also continue to increase. Considering the increasing pressure for environmental protection to improve people's lives and sustain long-term economic growth, China currently puts strong emphasis on environmental protection.

Sample and data sources

In China, the Ministry of Environmental Protection publicized a list of strictly regulated industries, including manufacturing, power-generation, and mining industries (Marquis & Bird, 2018). Firm pollution is specifically pronounced, and environmental innovation is essential in such industries, so they provide a particularly appropriate sample for testing our hypotheses. Our sample includes all the Chinese listed firms (A shares) of heavily polluting industries on the Shenzhen and Shanghai Stock Exchanges from 2013 to 2017. We selected 2013 as our starting year because one of our key dependent variables, pollution frequency, was only properly available in 2013.

Our data sources contain archival data from the China Stock Market and Accounting Research (CSMAR) database, the WIND database, environmental penalty reports from the Institute of Public and Environmental Affairs (IPE; http://www.ipe.org.cn), and the Baiteng patent network (http://www.baiteng.cn/). We further removed firm-year observations with missing values and obtained a final sample of 6664 firm-year observations from 1509 listed firms.

Dependent variable

Firm pollution

The Pollution List is the first relatively thorough and authoritative blacklist that discloses firm pollution issues of Chinese listed firms. The

list is compiled by IPE (the Institute of Public and Environmental Affairs), which is an environmental nonprofit organization, on the basis of the real-time monitoring of pollution sources. The list is published by the Securities Times, the national top one specialized financial securities daily newspaper designated by the China Securities Regulatory Commission to disclose the information of listed firms. The number of times a firm appears on the list indicates the frequency at which that firm engages in pollution-causing activities. Therefore, the measure of firm pollution is the frequency at which firms appear on the Pollution List, which is 0 if the firms do not appear on the list (Marquis & Bird, 2018; Zhang et al., 2018). In our data set, 753 observations (approximately 10.94% of the sample) were published on the list, and Tangshan Jidong Cement Co., Ltd. was the most frequently listed (107 times in 2017). We also used a pollution dummy variable (which equals 1 if a firm has appeared one or more times on the Pollution List; 0, otherwise) as a different measure of the dependent variable in the robustness check.

Environmental innovation

Consistent with Brunnermeier and Cohen (2003), we used a successful environmental patent number as a proxy for environmental innovation (0 if the focal firm has no environmental patents). We first adopt web-crawler technology by using Python programing to automatically search all three types of a successful patent (i.e., patent for invention, patent of the utility model, and patent of appearance) of a listed company and its subsidiary corporation in the Baiteng patent network (https://www.baiten.cn/). The environmental patents of sample observations are then selected according to China's actual economic conditions by using the following Chinese keywords: "environmental protection," "environmental pollution," "pollution prevention," "energy saving," "emission reduction," "low carbon," "waste disposal," "sustainable," "ecology," "green," and "cycling" (Bansal & Clelland, 2004; Cormier & Magnan, 2015). A second researcher read all environmental patents and removed some patents that contain the keywords but do not describe environmental innovation (e.g., "green" describing color, as opposed to environmental protection). We finally obtained 3065 observations (approximately 46% of the samples) with environmental patents, and Midea Group Co., Ltd had the largest number of environmental patents (478 patents in 2016). The measure of environmental innovation is the number of successful environmental patents that a firm possesses, which equals 0 if the focal firm has no environmental patent. In the robustness test, we also divided our sample into two categories, which equals 1 if the firm has one or more environmental patents in year t; 0, otherwise. We then used this environmental innovation dummy variable as a different measure of the dependent variable.

Independent variable

Military experienced executives

We first collected the biographical information of each executive of listed firms from the CSMAR database to obtain information on their military backgrounds. When an executive's biographical information is unavailable from this source, we searched the WIND database, corporate annual reports, the Sina Finance website, and corporate web pages. Then, we manually collected executives' biographical information to complete the source. Following previous literature in the Chinese context (Jia, 2014; Li & Liang, 2015), our measure of executives considers both chairmen and CEOs. We used the biographical information to construct the variable of military experienced executives, which equals 1 if one of CEO and chairman of the focal firm served in the military or graduated from a military academy, equals 2 if CEO and chairman both have military background, and 0 if none of CEO and chairman has military background.

Moderating variable

Military officer rank

We used the highest rank obtained by a military experienced executive before retiring from the military to construct the binary variable of military officer rank, which equals 1 if the military experienced executives had a military officer rank (e.g., lieutenant, colonel, general) and 0 if the military experienced executives were regular soldiers during their military experience.

Pro-military culture

We first collected provincial-level annual Local Public Financial Expenditure and its details from the WIND database. When the details are unavailable from that source, we searched the website of the provincial finance department to complete the source. Following the suggestion of Certo et al., (2020) that ratio variables produce inaccurate parameter estimates, we calculated provincial-level pro-military culture as the sum of expenditure in soldier pension and retired soldier placement costs in focal province. This variable reflects the degree to which government institutions and people in a focal province value the military and retired soldiers. When a province has a high value, then retired soldiers are respected and provided with generous benefits in this province. In this case, we argue that the pro-military culture is strong. To avoid confounding the effect of expenditure in soldier pension and retired soldier placement costs with a province size effect, we also controlled for total provincial public financial expenditure in a given year.

Control variables

We included several variables to control for firm characteristics and industry factors that are found in previous studies to affect their susceptibility to environmental innovation and propensity for firm pollution. We controlled for duality and board independence as executives and board characteristics that may influence firms' behaviors. When the CEO also serves as the chair of the board of directors, they have less constrains from the board and have more discretion in the decision-making process. Therefore, we controlled duality in our model, which is coded 1 when the CEO is also the chairman of the board in given year; 0, otherwise. Top executives' behaviors can be monitored by independent outside directors (Chang, Oh, Park, & Jang, 2017), possibly affecting whether top executives' decisions can be implemented. Thus, we calculated board independence as the ratio of the number of independent directors to the total number of directors on the board (Johnson et al., 2013).

We also controlled for several firm-level characteristics. In line with the argument of prior research, the firms affiliated with government face greater obligations to implement policies aimed at innovation and environmental protection. Therefore, we controlled for whether a firm had political ties by coding 1 if either the chairman or the CEO was a delegate to the People's Congress or the People's Political Consultative Conference in a given year (Jia, 2014), and 0 if otherwise. Old firms are inclined to be more social responsible, because they are more care about reputation and legitimacy built over the years than newly listed firms (Zhang et al., 2018). Thus, we controlled for listing age, which is calculated as the natural logarithm of 1 plus the number of years since the firm has been listed on the Shanghai/Shenzhen Stock Exchange (Ref & Shapira, 2017; Zhang et al., 2018). Large firms possess greater resources to participate in environmental innovation but may also have higher potential environmental risks than small firms. Therefore, we controlled for potential economies of scale in firm environmental strategies by incorporating firm size variable, which is operationalized as the natural logarithm of total sales (Koch-Bayram & Wernicke, 2018). Firms with more potential slack can enable firms to invest in environmental protection activities or take risky initiatives, such as innovation; thus, we controlled for equity ratio, which is the total equity divided by the total debt in a given year (Greve, 2003). Firms with new equipment and clean technologies tend to have good environmental performance (Clarkson, Li, Richardson, & Vasvari, 2008), so they are less likely to participate in pollution. Thus, we controlled for capital intensity, which is calculated as capital spending over total sales revenues (Clarkson et al., 2008; Marquis & Bird, 2018). Specialized assets cannot be easily reallocated from existing uses and firms except at a significant loss of productive value or at a deep discount (Berrone et al., 2013; Dierickx & Cool, 1989). Firms with more specialized assets bear great risk and are more concerned about the effects of revealing pollution. Therefore, we controlled for asset specificity in our model, which is operationalized as the logarithm of the ratio of the book value of a firm's fixed asset to the number of employees (Berrone et al., 2013).

Given that R&D intensity is a primary input of firm patent development process, we controlled for R&D intensity and calculated it as the logarithm of R&D expenditures divided by the total sales (Berrone et al., 2013; Chen & Miller, 2007; Greve, 2003). We included patent number, which is the log-transformed ration of the total number of patents to the total employees plus one as a control for two reasons. First, the patent number variable partially reflects the technology portfolio of a firm (Ahuja & Morris Lampert, 2001) and controls for a firm's ability to develop innovation (DeCarolis & Deeds, 1999). Second, patent number controls for factors that may affect a firm's tendency to patent, such as CEO who prefers an aggressive patenting strategy (Berrone et al., 2013).

Given that the duration of military experience may relate to promotion, when testing the moderating effect of military officer rank, we controlled duration of military experience, which equals the length of military service time if the focal executive had military experience, and 0 if the executive did not have military experience. In doing so, we can confirm the mechanism that it is really military officer rank and not simply a function of the duration of military experience leads to a strong imprinting effect.

Empirical model and estimation method

Considering the count nature of our dependent variable (i.e., frequency of firm appearance on the list and the number of environmental patents), we should use nonlinear estimators such as negative binomial regression and Poisson models (Hausman, Hall, & Griliches, 1984). For example, the probability of numerous firms appearing on the list can be modeled as resulting from a Poisson model, which is given as

$$\Pr(Y_{it} = y) = \frac{e^{-\mu_i}\mu_i^{y_i}}{y_i!}$$

where Y_{it} represents the number of firm i in year t appearing on the list. The mean value μ_i is parameterized in terms of x_i, the vector of attributes, and coefficient vector β.

$$\mu_i = \exp(x'_{it}\beta)$$

However, the Poisson model restricts that the mean and variance should be equal, which may be an unreasonable assumption. The negative binomial regression model extends the Poisson regression model by allowing the variance of the process to exceed the mean (Cameron & Trivedi, 1998). By using the Lagrange Multiplier test, we conducted preliminary exploratory analysis of the data. The result rejects the pure Poisson model and supports a model in which the variance is proportional to the mean, suggesting negative binomial regression model fit our dataset. Given that many zero observations exist in our two datasets, we computed Vuong statistic with corrections based on the Akaike and Bayesian (Schwarz) information criteria (Desmarais & Harden, 2013) to test which method (standard negative binominal regression vs. zero-inflated negative binominal regression) fits in the two datasets accordingly (firm pollution dataset vs. environmental innovation dataset). According to Vuong statistic with corrections, we tested our hypotheses related to firm pollution by using zero-inflated negative binomial regression and tested hypotheses related to environmental innovation by using standard negative binomial regression (Berrone et al., 2013; Hoetker & Agarwal, 2007). Moreover, given that our two datasets were made up of a panel of observations that were repeated for each firm, we needed to test our hypotheses by using a firm fixed-effect model to control for any unobserved stable firm differences. However, our datasets have time-invariant variables (e.g., executive characteristics), which prevented us from controlling for firm fixed effects by including a set of dummy variables. Therefore, we reached an algebraically equivalent solution by including the cluster mean of all level 1 time-variate variables in a random effect model (Antonakis, Bastardoz, & Rönkkö, 2021). We also calculated the cluster robust standard errors at the industry level.

A potential endogeneity in our study is that unobservable characteristics are correlated with both executives' decision of joining the army and firm environmental strategies; therefore, military experienced executives may be endogenous and self-selected. To address this issue, we ran a two-stage treatment effects model (Certo, Busenbark, Woo, & Semadeni, 2016; Kennedy, 2008; Shaver, 1998). As the probability of being drafted into military service differs by year of birth due to the polices and the heightened demand for age-eligible men during periods of war and conflicts, individuals' birth year may identify the different likelihood of having served in the military. Thus, in our first-stage Probit model, we followed prior research (Koch-Bayram & Wernicke, 2018; Benmelech & Frydman, 2015) and regressed military experienced executives on executives' birth year, all control variables mentioned above, industry and year dummy variable. A hazard ratio was then generated in the first-stage analysis, and we included it in the second-stage model as endogeneity control to correct the bias.

Considering the nature of the innovation process (i.e., complexity and serendipity), the explanatory variable (i.e., military experienced executives) is unlikely to immediately generate environmental patents. The same holds for firm pollution. Therefore, we lagged our dependent variables by one year (i.e., firm pollution and environmental innovation in year T + 1) to establish the causal link. To model the change that military experienced executives bring about, we included prior firm pollution and prior environmental innovation variables (i.e., firm pollution and environmental innovation in year T) as controls in our model. To ensure that our results are not driven by outliers, we winsorized all continuous variables at the 1% and 99% levels. All regression models include industry and year fixed effects to control for unobserved heterogeneity across industries and annual trends in firm environmental strategies.

Results

Descriptive statistics

Table 1 shows the descriptive statistics and correlations for all the variables. The mean value of pollution frequency is 0.52, suggesting that serious environmental pollution problems occur in the sampled firms. Environmental innovation has a mean value of 3.19, indicating that environmental patents are rare for firms in our sample. All variance inflation factor (VIF) values are lower than 3, with a mean VIF of 1.34, indicating that multicollinearity among these variables is not a serious problem.

Hypothesis testing

Tables 2 and 3 show our main findings. Table 2 illustrates the results of the hypotheses tests related to firm pollution by using zero-inflated negative binomial regression with firm fixed effect (H1, H3a, and H4a). The dependent variable is firm pollution. Model 1 contains only our main independent variable, military experienced executives. Model 2 consists only the control variables. Model 3 adds our independent variables. Model 4 adds the interaction term between military experienced executive and pro-military culture. Model 5 contains only control variables and military officer rank. H1 argues that military experienced executives are negatively related to firm pollution. Model 3 of Table 2 presents that the effect of military experienced executives on firm pollution is significantly negative ($\beta = -2.399$, $p < 0.001$). The marginal effect for military experienced executives on firm pollution is -0.84, which indicates that, all else equal, firms with military experienced executives appear 0.84 times less on the Pollution List than firms with nonmilitary experienced executives. Thus, H1 receives strong empirical support. Model 4 of Table 2 exhibits that the interaction term between military experienced executives and pro-military culture is significantly negative ($\beta = -19.186$, $p < 0.001$), thus supporting H4a,[1] which suggests that military imprint is amplified and that military experienced executives are less likely to participate in firm pollution when they are working in regions where the pro-military culture is strong. Moreover, considering the concerns over interaction effects in nonlinear estimators (i.e., limited dependent variable models), we conducted further analyses to confirm the significance of this moderating effect. Following Bowen's (2012) approach, we decomposed the total moderating effect into the structural moderating effect and the secondary moderating effect. The test results verify that this moderating effect is statistically significant.[2] In our study, when military experienced executive variable equals 0, military officer rank variable must equal 0. This means that the variable of "military experienced executives $\times$ military officer rank" is actually the same as military officer rank variable. When we included these two variables into our model to test the moderating hypothesis, one variable would be omitted, which would mean that the model was misspecified. To test H3a, which argues that military officer rank strengthens the relationship between military experienced executives and firm pollution, we investigated the effect of military officer rank on firm pollution in the military experienced executives sample. Model 5 of Table 2 reveals that the effect of military officer rank on firm pollution is significantly negative ($\beta = -0.131$, $p < 0.01$), suggesting that military experienced executives with officer

---

[1] We further computed the marginal effect of military experienced executives on firm pollution at different values of the moderator variable (i.e., *pro-military culture*). The tests suggest that when external pro-military culture is weak (one standard deviation below the mean), having an executive served in the military leads to 0.13 times less in appearing on the Pollution List. By contrast, when external pro-military culture is strong (one standard deviation above the mean), having an executive served in the military leads to 0.89 times less in appearing on the Pollution List.

[2] We summarized the details of Bowen's (2012) approach and the test results in Appendices. The same goes for the moderating hypothesis H4b.

Table 1

Descriptive statistics and correlations.[a]

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Firm pollution	0.52	2.74	1																		
2. Environmental innovation	3.19	16.22	0.00	1																	
3. Prior firm pollution	0.20	1.18	0.03*	−0.01	1																
4. Prior environmental innovation	2.37	13.59	0.01	0.90*	−0.00	1															
5. Military experienced executives	0.05	0.24	−0.03*	0.02	0.02	−0.02*	1														
6. Military officer rank	0.01	0.12	−0.02	0.03*	0.01	−0.01	0.58*	1													
7. Pro-military culture	52,918	97,381	−0.00	0.06*	−0.03*	0.06*	0.04*	0.08*	1												
8. Duality	0.27	0.45	−0.01	0.00	−0.01	0.01	−0.01*	−0.03*	−0.03*	1											
9. Board independence	0.37	0.05	0.00	−0.00	−0.02	0.00	−0.03*	−0.04*	−0.04*	0.10*	1										
10. Firm size	21.35	1.46	0.09*	0.30*	0.02	0.28*	−0.06*	−0.05*	0.07*	−0.16*	−0.06*	1									
11. Listing age	2.07	0.84	0.09*	0.04*	0.06*	0.04*	−0.04*	−0.03*	0.01	−0.23*	−0.03*	0.30*	1								
12. Political tie	0.31	0.46	−0.00	−0.01	−0.02	−0.02	0.01	0.01	−0.05*	0.06*	0.02	−0.03*	−0.22*	1							
13. Equity ratio	2.68	3.46	−0.05*	−0.07*	−0.02	−0.07*	0.04*	0.03*	−0.00	0.11*	0.02	−0.38*	−0.34*	0.06*	1						
14. R&D intensity	0.11	0.89	−0.01	−0.02	−0.01	−0.01	−0.01	−0.01	−0.01	−0.01	0.01	−0.24*	−0.19*	0.05*	−0.05*	1					
15. Patents number	0.01	0.02	0.00	0.12*	−0.01	0.13*	0.01	−0.00	0.10*	0.10*	0.06*	−0.19*	−0.15*	0.04*	0.14*	0.06*	1				
16. Capital intensity	0.12	0.14	−0.05*	−0.02*	−0.01	−0.02*	0.01	0.01	0.00	0.02	0.00	−0.10*	−0.07*	−0.01	−0.02	−0.01	−0.06*	1			
17. Asset specificity	13.22	1.02	0.09*	0.05*	0.05*	0.05*	0.02	0.03*	0.05*	−0.14*	−0.03*	0.29*	0.26*	−0.07*	−0.15*	−0.09*	−0.13*	0.29*	1		
18. Financial expenditure	6.2*10^7	2.8*10^7	0.02	0.05*	0.07*	0.07*	0.04*	0.06*	−0.28*	0.14*	0.06*	−0.00	−0.13*	0.01	0.04*	−0.04*	0.14*	−0.13*	−0.05*	1	
19. Duration of military experience	0.07	0.30	−0.03*	0.01	0.01	−0.02	0.83*	0.59*	0.03*	−0.02	−0.02*	−0.05*	−0.05*	0.01	0.04*	−0.01	0.03*	0.01	0.01	0.07*	1

Notes. *p < 0.05; N = 6664 firm-year observations from 1509 firms for years between 2013 and 2017.

[a] As our sample includes all the Chinese listed firms (A shares) of heavily polluting industries on the Shenzhen and Shanghai Stock Exchanges from 2013 to 2017, the composition of the observations is fundamentally different from what the scholars of corporate governance mainly focus on (i.e., S&P 500 sample).

rank are less likely to participate in firm pollution than those without officer rank. Thus, H3a receive support.[3]

Table 3 demonstrates the results of the hypotheses tests related to environmental innovation by using standard negative binominal regression with firm fixed effect (H2, H3b, and H4b). Model 8 of Table 3 reveals that military experienced executives are positively and significantly associated with environmental innovation (β = 8.618, p < 0.001). The marginal effect for military experienced executives on environmental innovation is 3.46, which indicates that, all else equal, having an executive served in the military is associated with additional 3.46 times of environmental patents. The result thereby supports H2. H4b argues that pro-military culture strengthens the relationship between military experienced executives and environmental innovation. Model 9 of Table 3 shows that the interaction between military experienced executives and pro-military culture is significantly positive (β = 0.819, p < 0.001), supporting our contention that imprint–environment fit influences the persistence of the military imprint. Thus, H4b is supported.[4] Model 10 of Table 3 reveals that the effect of military officer rank on environmental innovation is significantly positive (β = 1.092, p < 0.05) when using the military experienced executive sample. Thus, H3b is supported, which suggests that military officer rank strengthens the relationship between military experienced executives and environmental innovation.[5]

Robustness tests and endogeneity concerns

To ensure the reliability of the results, we conducted several supplemental analyses that we describe next. First, we adopted the propensity score matching (PSM) method (Garrido et al., 2014; Li, 2013; Rosenbaum & Rubin, 1983; Rubin, 2001; Shipman, Swanquist, & Whited, 2017) as a robust test to address the problem that the observations of military experienced executive account for a relatively small part of our sample. In the first stage, we used Probit to regress military experienced executives on firm size, board independence, listing age, equity ratio, and industry dummies. Basing on the estimated propensity score generated from the first-stage model, we then matched firms run by military experienced executives with those without military experienced executives with replacement. We used the two-nearest neighbor matching approach to identify the matching sample because our sample only has 255 military experienced executive observations. Afterward, we reran all the models mentioned above, except for models that contain military officer rank, with standard negative binomial estimations method with firm fixed effect. We summarized the balance statistics and the results, which support H1,2, 4a, and 4b, in Appendix A.

Second, as discussed in our primary estimation section, military experienced executives may be endogenous. In addition, firms may systematically select executives with a specific background and executives may select firms on the basis of their human capital, thus also resulting in endogeneity. Therefore, to account for potential endogeneity in our model, we used an instrumental variable technique (Antonakis et al., 2010; Bascle, 2008; Semadeni, Withers, & Certo, 2014). We used martyr army culture and general army culture as

---

[3] Further tests suggest that firms appear 0.74 times less on the Pollution List when they have a military experienced executive without a military officer rank than firms with nonmilitary experienced executive. Contrastingly, having a military experienced executive with a military officer rank leads firms to appear 0.95 times less on the Pollution List than having a nonmilitary experienced executive.

[4] Further tests suggest that when external pro-military culture is weak (one standard deviation below the mean), having an executive served in the military leads to 1.8 times more in environmental patents. Contrastingly, when external pro-military culture is strong (one standard deviation above the mean), having an executive served in the military leads to 5.0 times more in environmental patents.

[5] Similarly, further tests suggest that having a military experienced executive without a military officer rank leads to 2.1 times more in environmental patents than having a nonmilitary experienced executive. Adversely, having a military experienced executive with a military officer rank leads to 15.2 times more in environmental patents.

Table 2
Zero-inflated negative binomial estimations of military experienced executives on firm pollution.

	Dependent variable: firm pollution in t + 1				
	(1)	(2)	(3)	(4)	(5)
Duality		−0.052	−0.048	−0.056	0.047
		(0.079)	(0.079)	(0.078)	(0.052)
Board independence		−0.056	−0.047	−0.052	0.013
		(0.054)	(0.054)	(0.054)	(0.024)
Firm size		0.633**	0.630**	0.622*	−0.016
		(0.243)	(0.241)	(0.242)	(0.079)
Listing age		0.198	0.204	0.203	−0.080
		(0.491)	(0.463)	(0.467)	(0.160)
Political tie		−0.189	−0.174	−0.180	0.016
		(0.137)	(0.140)	(0.139)	(0.053)
Equity ratio		0.021	0.045	0.044	0.008
		(0.093)	(0.083)	(0.085)	(0.015)
R&D intensity		0.032	0.027	0.025	−0.033
		(0.173)	(0.171)	(0.171)	(0.054)
Patents number		0.015	0.026	0.023	0.043
		(0.178)	(0.172)	(0.173)	(0.035)
Capital intensity		0.062	0.071	0.071	0.022+
		(0.078)	(0.076)	(0.077)	(0.012)
Asset specificity		0.048	0.078	0.082	0.134
		(0.120)	(0.126)	(0.128)	(0.098)
Financial expenditure		0.041	0.052	0.047	0.010
		(0.049)	(0.048)	(0.048)	(0.036)
Prior firm pollution		3.595**	3.559**	3.564**	0.009
		(1.368)	(1.351)	(1.343)	(0.009)
Pro-military culture		−0.138**	−0.134**	−0.129**	−0.077*
		(0.043)	(0.042)	(0.041)	(0.035)
Hazard ratio	**1.527**	**−1.356*****	**8.607+**	**8.516+**	
	(0.981)	**(0.186)**	**(4.686)**	**(4.761)**	
Independent variable					
Military experienced executives	**−2.532*****		**−2.399*****	**−11.258*****	
	(0.378)		**(0.389)**	**(2.745)**	
Military experienced executives × Pro-military culture				**−19.186*****	
				(5.805)	
Duration of military experience					−0.093*
					(0.045)
Military officer rank					**−0.131****
					(0.047)
Constant	1.454***	1.319***	1.314***	1.310***	−0.545+
	(0.146)	(0.197)	(0.193)	(0.193)	(0.265)
Firm fixed effect	No	Yes	Yes	Yes	Yes
Year, industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	6664	6664	6664	6664	255
Likelihood	−3.3*10³	−3.2*10³	−3.2*10³	−3.2*10³	−71.471

Notes: The coefficients for continuous variables are standardized. Cluster robust standard errors at industry level in parentheses. Significance levels: $^+$ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.

two instrumental variables. First, martyr army culture is a dummy variable, which equals 1 if a firm's CEO or chairman was born in a province in which the number of martyrs sacrificed in the Wars to Resist U.S. Aggression and Aid Korea (WRUAAK) is above the median, and 0 if the number below the median. Occurring the establishment of People's Republic of China, WRUAAK was the longest war in China that lasted from 1950 to 1953. Furthermore, the Chinese government built a special memorial hall dedicated to the memory of the martyrs and several heads of Chinese government, such as Xiaoping Deng, Zemin Jiang, Jintao Hu, and Jinping Xi, took part in the activities related to the memorial hall. Moreover, soldiers who survived the war are highly respected and provided with generous benefits. Accordingly, the WRUAAK significantly affected Chinese teenagers. A man tends to be deeply affected by martyr army culture from childhood if his/her birthplace has many martyrs in the WRUAAK, and hence he/she is likely to join the army or engage in relevant military affairs. Second, general army culture is a dummy variable, which equals 1 if a firm's CEO or chairman was born in a province in which the weighted number of marshals and generals conferred in 1955 is above the median, and 0 if the weighted number is below the median. Conferring military

title among Chinese People's Liberation Army in 1955 is the first and biggest military conferment activity after the establishment of People's Republic of China in 1949. In this activity, the Chinese government conferred soldier military officer rank according to his/her contributions to the country's revolutionary causes. Accordingly, the number of marshals and generals in each province will have a "demonstration effect" and "celebrity effect" on young people in that province, such that the young people will be inspired to join the army. The higher the number of marshals and generals, the more likely an individual was influenced by the army culture, and thus he/she will be more likely to join the army. To account for the influence of different military officer ranks, we assigned different weights according to the ranks. Among them, the weight ratio of marshal, general, admiral, and lieutenant general is 4:3:2:1 respectively.

Both measures related to birthplace of CEO or chairman may affect focal individuals' tendency of joining the army, but are not related to a firm's environmental strategies in CEO's or chairman's current working place. To empirically validate the IV estimates can be trusted and the two IVs are exogenous, we conducted four tests. First, we conducted a Hausman test to compare the instrumental and non-

Table 3
Standard negative binomial estimations of military experienced executives on environmental innovation.

	Dependent variable: firm environmental innovation in t + 1				
	(6)	(7)	(8)	(9)	(10)
Duality		−0.080	−0.082	−0.083	−0.553
		(0.086)	(0.085)	(0.081)	(0.351)
Board independence		0.038	0.121**	0.104**	−0.197
		(0.033)	(0.042)	(0.037)	(0.136)
Firm size		0.313**	0.307**	0.290*	0.186
		(0.114)	(0.115)	(0.123)	(0.471)
Listing age		0.087	0.084	0.111	0.421
		(0.172)	(0.174)	(0.168)	(0.416)
Political tie		0.103*	0.132**	0.136**	−0.525
		(0.052)	(0.049)	(0.046)	(0.389)
Equity ratio		0.020	0.024	0.008	−0.185*
		(0.057)	(0.060)	(0.069)	(0.091)
R&D intensity		0.099	0.121	0.103	0.171
		(0.116)	(0.112)	(0.115)	(0.515)
Patents number		−0.054	−0.051	−0.050	0.103
		(0.051)	(0.048)	(0.050)	(0.089)
Capital intensity		0.006	0.008	0.005	−0.092
		(0.038)	(0.038)	(0.038)	(0.070)
Asset specificity		0.113	0.111	0.112	−0.138
		(0.084)	(0.082)	(0.081)	(0.124)
Financial expenditure		0.108**	0.111**	0.116***	−0.704**
		(0.037)	(0.035)	(0.033)	(0.227)
Prior environmental innovation		0.043*	0.042+	0.043+	0.154**
		(0.022)	(0.022)	(0.022)	(0.050)
Pro-military culture		0.125***	0.124***	0.075*	0.280***
		(0.027)	(0.030)	(0.032)	(0.082)
Hazard ratio	**−2.187***	**0.708***	**−3.251**	**−2.566***	
	(1.080)	**(0.132)**	**(1.167)**	**(0.607)**	
Independent variable					
Military experienced executives	**5.553**		**8.618***	**6.711***	
	(1.983)		**(2.462)**	**(1.326)**	
Military experienced executives × Pro-military culture				**0.819***	
				(0.203)	
Duration of military experience					0.041*
					(0.020)
Military officer rank					**1.092***
					(0.499)
Constant	0.582***	−0.507*	−0.812***	−0.656**	−0.218
	(0.106)	(0.197)	(0.225)	(0.215)	(0.551)
Firm fixed effect	No	Yes	Yes	Yes	Yes
Year, industry fixed effects	Yes	Yes	Yes	Yes	Yes
N	6664	6664	6664	6664	255
R square	0.019	0.101	0.103	0.106	0.146

Notes. The coefficients for continuous variables are standardized. Cluster robust standard errors at industry level in parentheses. Significance levels: + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

instrumental model. The result shows a P value of 0.003, which suggest that non-instrumental model is biased and the IV estimates should be retained. Second, we used a Bayesian test for under-identification to ensure that our equation was adequately identified. Third, we did a weak identification test to evaluate the explanatory power of these two instrumental variable. The results show a Kleibergen-Paap Wald F-statistic of 15.22 (above the cut-off of 10), which suggest that these two instrumental variables are strong. Fourth, considering that we had two instruments for one endogenous variable, we also performed an over-identification test (i.e., Sargan test). The results show a rather small test coefficient with a p-value of 0.3277, suggesting that we cannot reject the null hypothesis that our instruments are exogenous and uncorrelated with the error term. All above results give us confidence in our IV estimates and the choice of instrument variables (Bascle, 2008; Sajons, 2020).

We summarized the results in Appendix B. Consistent with our expectation, in the first-stage model, martyr army culture and general army culture are positively and significantly related to executives' military experience. In the second-stage model, the results suggest that military experienced executives are negatively related to firm pollution and positively related to environmental innovation. Moreover,

the effect of military experienced executives on firm pollution and environmental innovation is strengthened when the pro-military culture is strong. Thus, after considering the endogeneity by using IV estimates, the results further support H1, H2, H4a, and H4b.

Third, controlling for endogenous variables when the key predictors are endogenous will result in biased estimation. As we control previous values of dependent variables (i.e., firm pollution and environmental innovation in T), which may be endogenous, we estimated a dynamic panel data model as a robust test to address this issue (Arellano & Bond, 1991). Specifically, we used differenced generalized method of moments (GMM) estimator, where lagged dependent variable was included among the regressors. To empirically validate the GMM estimates is consistent (i.e., not biased), we conducted two tests. First, considering the basic assumption of GMM estimates is not autocorrelation among error terms, we performed Arellano-Bond test for serial correlation in the first-differenced errors. The results show that the differenced residuals has first order autocorrelation (P value of AR (1) in all models below 0.05) but has not second order autocorrelation (P value of AR(2) in all models above 0.1), which suggest not autocorrelation among error terms. Second, we conducted Sargan test to examine the issue of over-identification. The results show that the p-

value in all model above 0.1, suggesting we cannot reject the null hypothesis that all instruments are valid. These two tests confirm that the differenced GMM model is not biased. We summarized the results in Appendix C and all hypotheses are supported.

Fourth, to verify that the reported results are robust, we used different measures of the dependent variables. Specifically, we conducted the check with the pollution dummy variable (which equals 1 if a firm has appeared one or more times on the Pollution List in year t; 0, otherwise) as the dependent variable. Then, we tested the hypotheses related to firm pollution by Logit with firm, industry and year-fixed effects. We summarized the results in Appendix D. Furthermore, we conducted the check with the environmental innovation dummy variable (which equals 1 if the firm has one or more environmental patents in year t; 0, otherwise) as the dependent variable. Following, we tested the hypotheses related to firm environmental innovation by Logit with firm, industry and year-fixed effects. We summarized the results in Appendix E. In sum, the results of the above two tests support H1, H2, H3b, H4a, and H4b but not H3a.

Fifth, we constructed other forms of independent variables. Military CEO and Military chairman are dummy variables that equal 1 if the CEO or chairman, separately, served in the military or graduated from a military academy; 0, otherwise. Similarly, when the independent variable is Military CEO, Military officer rank takes the value of 1 if the CEO had a military officer rank and 0 if the CEO was regular soldiers during his/her military experience. The same goes for Military Chairman. We reran all the models mentioned above with these two independent variables respectively and corresponding moderator variable. We summarized the results in Appendix F. Specifically, when testing the effect of Military CEO, H1, H2, and H4b receive support but H3a, H3b, H4a do not. Furthermore, when testing the effect of Military Chairman, H1, H2, H3b, H4a, and H4b are supported but not H3a.

Sixth, we constructed continued forms of independent variables—using the duration of military experience to measure executives' military experiences. We tested the hypotheses related to firm pollution, environmental innovation, and pro-military culture by negative binomial estimations with firm, industry and year-fixed effects. We summarized the results in Appendix G. The results show that the duration of military experience is negatively and significantly related to firm pollution, and positively and significantly related to environmental innovation. Such effects are strengthened when focal executives work in regions in which the pro-military culture is strong. In general, the results support H1, H2, H4a, and H4b.

Finally, in the primary analysis section, we lagged our dependent variables by one year to establish the causal link. Lieberson and O'Connor (1972) demonstrated that leadership effects are at strongest at approximately two years into their tenure. Thus, we lagged our dependent variables by two years and conducted our analyses again. We summarized the results in Appendix I. Specifically, The results support H1, H2, and H4b. However, H3a, H3b, and H4a are not supported.

Given that we did not always find full support for all hypotheses in the various robustness checks, we summary all tests' specification in brief and whether specific hypotheses are supported or not in specific estimates in the following hypotheses testing overview table. (See Table 4).

Discussion

General discussion

Prior studies on military experienced executives mostly focus on U. S. firms (Benmelech & Frydman, 2015; Koch-Bayram & Wernicke, 2018; Law & Mills, 2017; Malmendier et al., 2011). However, whether the characteristics exhibited by military experienced executives in U.S.

firms are likely to be observed similarly in other countries with distinct differences in socio-economic features remains uncertain. Various combinations of civil organizations, industrial norms, culture environments, and state regulations may cause different modes of discipline and belief between the U.S. and Chinese army.

In this study, employing imprinting theory as a framework, we focus on military experienced executives and investigate their potential effect on firm pollution as well as environmental innovation simultaneously. Basing on the dataset of heavily polluting industries from Chinese-listed firms, we argue that military experience imprints executives with the values of willingness to follow rules and stewardship for the collective, making them likely to follow the environmental regulations and behave in ways that serve the long-term welfare of society. Specifically, we generally find that compared with nonmilitary experienced executives, military experienced executives are less likely to engage in firm pollution and more likely to participate in environmental innovation. Overall, testing how military experienced executives affect both negative and positive components of firm environmental strategies can lead to a more thorough understanding of the military imprinting effect on firm environmental strategies. We further theorize about the strength of imprint and divide the strength of military imprint into two types: the strengths of imprint at its formation and at its persistence, and investigate factors that affect each of them. This theoretical separation allows us to systematically hypothesize the factors that affect the strength of military imprint. Specifically, our study finds that the strength of military imprint at its formation is intensified if the focal individual had military officer rank. Furthermore, the persistence of the imprint is influenced by current imprint–environment fit. Working in a strong pro-military culture environment brings the imprint to the fore, thereby intensifying the strength of imprint at its persistence.

When testing the moderating effect of military officer rank, we control duration of military experience and we find that military officer rank still leads to a strong imprinting effect. Given that duration of military experience may relate to promotion, this interesting result confirms our mechanism that some imprinting happens during the process of officers' promotion and training (i.e., higher-level socialization) and doesn't just happen through the duration of military experience (i.e., longer-time socialization).

It should be noticed that, according to contact theory logic (Pettigrew & Tropp, 2006; Wagner et al., 2006), the effect of military experienced executives is likely to be strengthened in a weak pro-military culture environment because military experienced executives' presence is salient in this condition, leading to a converse argument with our hypotheses H4a and H4b. However, according to imprinting theory, unlike dispositional traits, the imprint reflects elements of original environment, and thus its expression needs stimulation and cues from current environment (Tilcsik, 2014). That is, the congruence between the initial, formative context and subsequent conditions may lead individuals to resonate strongly with outside stimulation, thus strengthening the imprint (Tilcsik, 2014).

Theoretical contributions

This research has several important theoretical contributions. First, we make a theoretical contribution to imprinting research by emphasizing the importance of considering imprint formation and imprint persistence (Marquis & Tilcsik, 2013). Our results show that early-life experience leaves an imprint on individuals and that the strength of imprint depends not only on the extent of socialization at the stage of imprint formation but also on imprint–environment fit at the stage of imprint persistence. In this vein, our theoretical separation of the strength of imprint (i.e., the strength at its formation and at its persistence) allows us to systematically hypothesize the factors that influence the effect of military imprint. Specifically, at the stage of imprint formation, most prior scholars took imprint formation for

Table 4
Hypotheses testing overview table.

Estimated method	H1: Military experienced executives negatively relate to firm pollution	H2: Military experienced executives positively relate to environmental innovation	H3a: Military officer rank strengthens the negative relationship between military experienced executives and firm pollution	H3b: Military officer rank strengthens the positive relationship between military experienced executives and environmental innovation	H4a: Pro-military culture strengthens the negative relationship between military experienced executives and firm pollution	H4b: Pro-military culture strengthens the positive relationship between military experienced executives and environmental innovation
Main estimates						
1 Two-stage treatment effects model + negative binominal regression with firm fixed effect	Support	Support	Support	Support	Support	Support
Robustness checks						
2 Propensity score matching (PSM) method	Support	Support	–	–	Support	Support
3 Instrumental variable method	Support	Support	–	–	Support	Support
4 Dynamic panel data model	Support	Support	Support	Support	Support	Support
5 Use firm pollution dummy variable and environmental innovation dummy variable as DV separately	Support	Support	Not support	Support	Support	Support
6 Use military experienced CEO as IV	Support	Support	Not support	Not support	Not support	Support
7 Use military experienced chairman as IV	Support	Support	Not support	Support	Support	Support
8 Use duration of military experience as IV	Support	Support	–	–	Support	Support
9 Lag DV by two years	Support	Support	Not support	Not support	Not support	Support
10 Model without control variables	Support	Support	Support	Support	Support	Support

Notes: IV is the abbreviation of independent variable, DV is the abbreviation of dependent variable. – means this hypothesis is not tested in this section due to military officer rank hypotheses only can be tested in the military experienced executives sample.

granted and failed to investigate why individuals form different strengths of imprint in an identical environment. In this study, we suggest and find that individuals with different ranks in the army may be receptive to the military environment to a different extent and hence are imprinted distinctly. Furthermore, at the stage of imprint persistence, the extent to which imprint amplifies or decays is an important yet understudied issue. In a review paper of imprinting theory, Marquis and Tilcsik (2013) called for future scholars to pay much attention on imprinting dynamics and encouraged them to explore how imprints amplify or decay under certain condition. In this study, according to Tilcik's (2014) perspective of imprint–environment fit, we examine another key contingent factor—pro-military culture, which helps individuals perpetuate the imprint and thus intensifies the effect of military imprint. Thus, our study provides a significant contribution to understanding why imprint changes over time and exists in various intensities in different environments.

Second, by demonstrating the influence of military experienced executives on firm pollution and environmental innovation, we extend the research of military experienced executives to corporate environmentalism literature and enrich the literature related to the corporate outcomes of military experienced executives (Benmelech & Frydman, 2015; Taylor, 2018; Wong et al., 2003). Recent empirical research demonstrates that military experienced executives are negatively related to alleged corporate fraud (Benmelech & Frydman, 2015), financial misconduct (Koch-Bayram & Wernicke, 2018), and tax avoid-

ance (Law & Mills, 2017). However, as firms are increasingly compelled to engage in societal contributions beyond mere regulatory compliance, the implication of military experienced executives for firm behaviors and outcomes fails to be extended to the context of corporate environmentalism. Accordingly, our study extends the research of military experienced executives to corporate environmentalism literature (Wang et al., 2018). In addition, researchers increasingly come to consider good deeds (e.g., environmental responsible activities) and bad deeds (e.g., environmental irresponsible activities) as conceptually distinct phenomena, with different implication for firms. Thus, our simultaneous examination of military experienced executives on negative and positive components of firm environmental strategies can lead to a thorough understanding of the imprinting effect on firm environmental strategies.

Third, we contribute to the leadership literature by extending imprinting theory to leadership literature. Contemporary studies that adopt an imprinting perspective generally focus on: entrepreneurial legacy (Jaskiewicz, Combs, & Rau, 2015; Kammerlander et al., 2015), human resource management (Kidwell, Eddleston, & Kellermanna, 2018; Kim, Bae, & Yu, 2013; Leung, Foo, & Chaturvedi, 2013), individual career trajectories (Azoulay, Liu, & Stuart, 2011; Tilcsik, 2014), and individuals' political ideology (Marquis & Qiao, 2018; Wang et al., 2019). However, scholars paid limited attention to the application of imprinting theory on leadership literature. Filling this research gap is important, because executives'

decision making is guided by their values and beliefs, which are largely shaped by experiences during their sensitive period. By embracing the insights of imprinting theory into leadership literature, this study suggests that although military experience occurred decades before individuals entered the corporate elite, the imprinting effect of military experience is not easily shed, but is inherent and persists in executives' decision-making processes.

Furthermore, by exploring how pro-military culture context affects the strength of military imprint and thus influences executives' decision making, we provide a unique mechanism to interpret how contextual factors might shape leadership practices, and hence contribute to a more comprehensive understanding of the context for leadership (Johns, 2006; Porter & McLaughlin, 2006; Oc, 2018). A considerable body of leadership literature focuses on how contextual factors may affect leadership practices and its consequences (e.g., Ayman & Adams, 2012; Chizema & Pogrebna, 2019; Hannah et al., 2009; Oc, 2018; Osborn, Hunt, & Jauch, 2002). Considering the mechanism of how context affects leadership, existing studies focus mostly on whether context restricts its range, changes the nature of particular relationships, affects the base rate, generates the curvilinear effects, tips precarious relationships, and threatens the generalizability of findings about leadership (Johns, 2006; Oc, 2018). In this study, we draw on insights of imprinting theory to suggest that context determines the strength of imprint and thus affects leadership outcomes. In doing so, we provide a new way to understand how context affects leadership practices (Oc, 2018).

Finally, we extend the studies on the antecedents of firm pollution and environmental innovation. Contemporary developments in the literature on firm environmental strategies focus mostly on two aspects: how institutional pressure leads to homogeneity in environmental strategies (Berrone et al., 2013; Maung, Wilson, & Tang, 2016), and exploring the factors that lead firms to exhibit heterogeneous strategies when faced with a common set of pressures (Lewis, Walls, & Dowell, 2014; Wong et al., 2018). Scholars' knowledge about how early life experiences of executives affect firm environmental strategies is limited. By demonstrating that the differences in environmental strategies can be explained by the executives' military imprint, we enrich the understanding of why firms vary in their pollution activities and environmental innovation. In particular, we emphasize that military experience imprints executives with values of willingness to follow rules and stewardship for the collective. The former motivates firms in heavily polluting industries to follow environmental regulations and thus participate less in firm pollution, whereas the latter motivates firms to behave in ways that serve the long-term welfare of society and thus involve more in environmental innovation. Accordingly, we open the "black box" of the relationship between military experienced executives and firm environmental strategies.

Practical implications

Our study has several practical implications. First, our study lends support to the assumption that executives' military imprint affects firm environmental strategies in China's heavily polluting industries. We find that military experienced executives are particularly beneficial for environmental innovation and encourage less firm pollution activities. At least for our study setting, governments, shareholders, and other stakeholders can anticipate the likelihood of environmental innovation to be high and the likelihood of firm pollution to be low when a firm is headed by an executive with a military background. Second, companies can screen certain types of candidates for their top positions by using military experience as a proxy for executives' characteristics of following rules or stewardship for the collective. Third, our results show that military experienced executives apply military values and norms (i.e., following rules and stewardship for the collective) into firm strategic decisions; hence, executives' identities may affect how the firms are viewed (Simpson & Sariol, 2018). For

example, firms headed by military experienced executives are regarded as less inclined to participate in potentially regulation-infringing activities. Hiring a military experienced executive can give the firm a good public image and benefit the firm by inducing positive responses from various stakeholders (Simpson & Sariol, 2018).

Limitations and future research

This research has a few limitations that deserve to be addressed in future research. First, we argue that military experience leaves an imprint, which instills the values of following rules and stewardship for the collective, on individuals. We use this argument to explain the mechanism linking military experienced executives and firm environmental strategies. However, we do not directly measure these imprinted characteristics. We encourage future scholars to measure these imprinted characteristics by using surveys or experimental studies. Second, when we discuss that military officer rank can strengthen the relationship between military experienced executives and firm environmental strategies, we provide an alternative explanation that individuals may obtain a military officer rank due to their dispositional traits (i.e., selection effect) instead of socialization effect (i.e., imprinting effect). However, selection effect and imprinting effect may result in homogenous characteristics, but in different mechanisms (for a detailed discussion about selection effect, see Wang et al., 2019; Koch-Bayram & Wernicke, 2018). To confirm the influence of imprinting effect in military officer rank section, we encourage future scholars with more specific data to use several robustness estimators (e.g., Propensity Score Matching) to exclude such alternative explanation (e.g., Marquis & Qiao, 2018). Third, considering the hard-work entailed in collecting data to directly measure firms' pollution performance in China, our measures for firm pollution are lightly coarse. Ultimately, firms may actually engage in pollution activities, but these activities may not be captured in the Pollution List for certain reasons. Although the Pollution List compiled by IPE is the first relatively thorough and authoritative blacklist that discloses firm pollution issues of Chinese-listed firms, we encourage future studies in other contexts where more specific measures of environmental performance are available. Similarly, our calculation of pro-military culture is also somewhat coarse. We admit that such construct is only a proxy for the degree to which the focal province values the military and retired soldiers in China. Hence, we encourage future researchers to collect more detailed data and analyze the variations of military imprint in different contexts. Fourth, because our sample period is not long enough (only five years with lags), after we lag dependent variables by two years in robustness test section, numerous observations were lost and some hypotheses cannot be tested. Future studies are encouraged to collect longer panel data to test the relevant hypotheses. Finally, although we conduct several robustness tests to address the endogeneity issue of independent variable, endogeneity with regard to control variables may be a potential issue. For example, being a good environmental corporate citizen (i.e., dependent variables in our study) may lead to increased political connections. Future researchers are encouraged to find a unique set of exogenous instruments for those potentially endogenous control variables or make a theoretical case for the exogeneity of these variables.

Conclusion

In this study, we extend imprinting theory to leadership literature and focus on how executives' military imprints affect firm environmental strategies in the context of heavily polluting industries in China. Our results show that military experienced executives are negatively related to firm pollution but positively related to environmental innovation. Moreover, the effect of military experienced executives on firm environmental strategies is strengthened when the focal exec-

utive had a military officer rank and when the focal executive is working in a strong pro-military culture environment. Overall, the findings of this study add evidence to the growing literature on imprinting theory, the influence of military experienced executives on corporate outcomes, and the antecedents of firm environmental strategies.

Funding

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Ahuja, G., & Morris Lampert, C. (2001). Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal, 22*(6-7), 521–543.

Akerlof, G. A., & Kranton, R. E. (2005). Identity and the Economics of Organizations. *Journal of Economic perspectives, 19*(1), 9–32.

Antonakis, J., Bastardoz, N., & Rönkkö, M. (2021). On ignoring the random effects assumption in multilevel models: Review, critique, and recommendations. *Organizational Research Methods, 24*(2), 443–483.

Antonakis, J., Bendahan, S., Jacquart, P., & Lalive, R. (2010). On making causal. claims: A review and recommendations. *The leadership quarterly, 21*(6), 1086–1120.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies, 58*(2), 277–297.

Arkin, W., & Dobrofsky, L. R. (1978). Military socialization and masculinity. *Journal of Social Issues, 34*(1), 151–168.

Asfar, R. (2009). TopVet: Lowell McAdam, Verizon Retrieved from https://www.veteransadvantage.com/blog/veterans-advantage-awards/topvet-lowell-mcadam-verizon.

Ayman, R., & Adams, S. (2012). Contingencies, context, situations, and leadership. In D. V. Day & J. Antonakis (Eds.), *The nature of leadership* (pp. 218–256). Thousand Oaks, CA: Sage.

Azoulay, P., Liu, C. C., & Stuart, T. E. (2011). *Social influence given (partially) deliberate matching: Career imprints in the creation of academic entrepreneurs (Working Paper)*. Cambridge: Harvard University.

Bansal, P., & Clelland, I. (2004). Talking trash: Legitimacy, impression management, and unsystematic risk in the context of the natural environment. *Academy of Management Journal, 47*(1), 93–103.

Bascle, G. (2008). Controlling for endogeneity with instrumental variables in strategic management research. *Strategic Organization, 6*(3), 285–327.

Benmelech, E., & Frydman, C. (2015). Military ceos. *Journal of Financial Economics, 117*(1), 43–59.

Berrone, P., Fosfuri, A., Gelabert, L., & Gomez-Mejia, L. R. (2013). Necessity as the mother of 'green' inventions: Institutional pressures and environmental innovations. *Strategic Management Journal, 34*(8), 891–909.

Briscoe, F., & Kellogg, K. C. (2011). The initial assignment effect: Local employer practices and positive career outcomes for flexible-work program users. *American Sociological Review, 76*(2), 291–319.

Brunnermeier, S. B., & Cohen, M. A. (2003). Determinants of environmental innovation in US manufacturing industries. *Journal of environmental economics and management, 45*(2), 278–293.

Bowen, F. E., Bansal, P., & Slawinski, N. (2018). Scale matters: The scale of environmental issues in corporate collective actions. *Strategic Management Journal, 39*(5), 1411–1436.

Bowen, H. P. (2012). Testing moderating hypotheses in limited dependent variable and other nonlinear models: Secondary versus total interactions. *Journal of Management, 38*(3), 860–889.

Cameron, A. C., & Trivedi, P. K. (1998). *Regression analysis of count data*. Cambridge, U. K.: Cambridge University Press.

Cao, F., Sun, J., & Yuan, R. (2019). Military experience and stock price crash risk: Evidence from China. Available at SSRN 3363694.

Certo, S. T., Busenbark, J. R., Kalm, M., & LePine, J. A. (2020). Divided we fall: How ratios undermine research in strategic management. Organizational Research Methods, 23(2), 211–37.

Certo, S. T., Busenbark, J. R., Woo, H.-S., & Semadeni, M. (2016). Sample selection bias and Heckman models in strategic management research. *Strategic Management Journal, 37*(13), 2639–2657.

Chang, Y. K., Oh, W.-Y., Park, J. H., & Jang, M. G. (2017). Exploring the relationship between board characteristics and CSR: Empirical evidence from Korea. *Journal of Business Ethics, 140*(2), 225–242.

Chen, W. R., & Miller, K. D. (2007). Situational and institutional determinants of firms' R&D search intensity. *Strategic Management Journal, 28*(4), 369–381.

Chizema, A., & Pogrebna, G. (2019). The impact of government integrity and culture on corporate leadership practices: Evidence from the field and the laboratory. *Leadership Quarterly, 30*(5), 101303. https://doi.org/10.1016/j.leaqua.2019.07.001.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, organizations and society, 33*(4-5), 303–327.

Cormier, D., & Magnan, M. (2015). The economic relevance of environmental disclosure and its impact on corporate legitimacy: An empirical investigation. *Business Strategy and the Environment, 24*(6), 431–450.

DeCarolis, D. M., & Deeds, D. L. (1999). The impact of stocks and flows of organizational knowledge on firm performance: An empirical investigation of the biotechnology industry. *Strategic management journal, 20*(10), 953–968.

Desmarais, B. A., & Harden, J. J. (2013). Testing for zero inflation in count models: Bias correction for the Vuong test. *The Stata Journal, 13*(4), 810–835.

Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management science, 35*(12), 1504–1511.

Dokko, G., Wilk, S. L., & Rothbard, N. P. (2009). Unpacking prior experience: How career history affects job performance. *Organization Science, 20*(1), 51–68.

Duffy, T. (2006). Military Experience & CEOs: Is There a Link? *Korn/Ferry*. International.

Elder, G. H. (1986). Military times and turning points in men's lives. *Developmental psychology, 22*(2), 233–245.

Ferdig, M. A. (2007). Sustainability leadership: Co-creating a sustainable future. *Journal of Change Management, 7*(1), 25–35.

Filatotchev, I., & Nakajima, C. (2014). Corporate governance, responsible managerial behavior, and corporate social responsibility: Organizational efficiency versus organizational legitimacy? *Academy of Management Perspectives, 28*(3), 289–306.

Fombrun, C. J., Gardberg, N. A., & Barnett, M. L. (2000). Opportunity platforms and safety nets: Corporate citizenship and reputational risk. *Business and Society Review, 105*(1), 85–106.

Fu, R., Tang, Y. i., & Chen, G. (2020). Chief sustainability officers and corporate social (Ir)responsibility. *Strategic Management Journal, 41*(4), 656–680.

Garrido, M. M., Kelley, A. S., Paris, J., Roza, K., Meier, D. E., Morrison, R. S., & Aldridge, M. D. (2014). Methods for constructing and assessing propensity scores. *Health services research, 49*(5), 1701–1720.

Godfrey, P. C., Merrill, C. B., & Hansen, J. M. (2009). The relationship between corporate social responsibility and shareholder value: An empirical test of the risk management hypothesis. *Strategic management journal, 30*(4), 425–445.

Greve, H. R. (2003). A behavioral theory of R&D expenditures and innovations: Evidence from shipbuilding. *Academy of management journal, 46*(6), 685–702.

Hannah, S. T., Uhl-Bien, M., Avolio, B. J., & Cavarretta, F. L. (2009). A framework for examining leadership in extreme contexts. *The Leadership Quarterly, 20*(6), 897–919.

Hausman, J. A., Hall, B. H., & Griliches, Z. (1984). Econometric Models for Count Data with an Application to the Patents-R&D Relationship. *Econometrica, 52*(4), 909–938.

Hernandez, M. (2008). Promoting stewardship behavior in organizations: A leadership model. *Journal of business ethics, 80*(1), 121–128.

Hernandez, M. (2012). Toward an understanding of the psychology of stewardship. *Academy of Management Review, 37*(2), 172–193.

Higgins, M. (2006). *Career Imprints: Creating Leaders across an Industry*. San Francisco: Jossey-Bass.

Hoetker, G., & Agarwal, R. (2007). Death hurts, but it isn't fatal: The postexit diffusion of knowledge created by innovative companies. *Academy of Management Journal, 50*(2), 446–467.

Jackson, J. J., Thoemmes, F., Jonkmann, K., Lüdtke, O., & Trautwein, U. (2012). Military training and personality trait development: Does the military make the man, or does the man make the military? *Psychological Science, 23*(3), 270–277.

Jaskiewicz, P., Combs, J. G., & Rau, S. B. (2015). Entrepreneurial legacy: Toward a theory of how some family firms nurture transgenerational entrepreneurship. *Journal of Business Venturing, 30*(1), 29–49.

Jia, N. (2014). Are collective political actions and private political actions substitutes or complements? Empirical evidence from China's private sector. *Strategic Management Journal, 35*(2), 292–315.

Johns, G. (2006). The essential impact of context on organizational behavior. *Academy of management review, 31*(2), 386–408.

Johnson, S. G., Schnatterly, K., & Hill, A. D. (2013). Board composition beyond independence: Social capital, human capital, and demographics. *Journal of management, 39*(1), 232–262.

Johnson (2007). 'What is organizational imprinting? Cultural entrepreneurship in the founding of the Paris Opera'. *American Journal of Sociology, 113*, 97–127.

Kammerlander, N., DessÙ, C., Bird, M., Floris, M., & Murru, A. (2015). The impact of shared stories on family firm innovation: A multi-case study. *Family Business Review, 28*(4), 332–354.

Kennedy, P. (2008). *A Guide to Econometrics* (2nd ed.). Oxford, UK: Blackwell.

Kidwell, R. E., Eddleston, K. A., & Kellermanns, F. W. (2018). Learning bad habits across generations: How negative imprints affect human resource management in the family firm. *Human Resource Management Review, 28*(1), 5–17.

Kim, Y., Bae, J., & Yu, G.-C. (2013). Patterns and determinants of human resource management change in Korean venture firms after the financial crisis. *International Journal of Human Resource Management, 24*(5), 1006–1028.

Kish-Gephart, J. J., & Campbell, J. T. (2015). You don't forget your roots: The influence of CEO social class background on strategic risk taking. *Academy of Management Journal, 58*(6), 1614–1636.

Koch-Bayram, I. F., & Wernicke, G. (2018). Drilled to obey? Ex-military CEOs and financial misconduct. *Strategic Management Journal, 39*(11), 2943–2964.

Kock, C. J., Santaló, J., & Diestre, L. (2012). Corporate governance and the environment: What type of governance creates greener companies? *Journal of Management Studies, 49*(3), 492–514.

Lange, D., & Washburn, N. T. (2012). Understanding Attributions of Corporate Social Irresponsibility. *Academy of Management Review, 37*(2), 300–326.

Law, K. K. F., & Mills, L. F. (2017). Military experience and corporate tax avoidance. *Review of Accounting Studies, 22*(1), 141–184.

Leung, A., Der Foo, M., & Chaturvedi, S. (2013). Imprinting effects of founding core teams on HR values in new ventures. *Entrepreneurship Theory and Practice, 37*(1), 87–106.

Lewis, B. W., Walls, J. L., & Dowell, G. W. S. (2014). Difference in degrees: CEO characteristics and firm environmental disclosure. *Strategic Management Journal, 35*(5), 712–722.

Li, M. (2013). Using the propensity score method to estimate causal effects: A review and practical guide. *Organizational Research Methods, 16*(2), 188–226.

Li, X.-H., & Liang, X. (2015). A Confucian Social Model of Political Appointments among Chinese Private-Firm Entrepreneurs. *Academy of Management Journal, 58*(2), 592–617.

Lieberson, S., & O'Connor, J. F. (1972). Leadership and organizational performance: A study of large corporations. *American sociological review, 37*(2), 117. https://doi.org/10.2307/2094020.

Lievens, F., Chasteen, C. S., Day, E. A., & Christiansen, N. D. (2006). Large-scale investigation of the role of trait activation theory for understanding assessment center convergent and discriminant validity. *Journal of Applied Psychology, 91*(2), 247–258.

Mackey, A., Mackey, T., & Barney, J. (2007). Corporate social responsibility and firm performance: Investor preferences and corporate strategies. *Academy of Management Review, 32*, 817–835.

Malmendier, U., Tate, G., & Yan, J. (2011). Overconfidence and early-life experiences: The effect of managerial traits on corporate financial policies. *The Journal of finance, 66*(5), 1687–1733.

Marquis, C., & Bird, Y. (2018). The paradox of responsive authoritarianism: How civic activism spurs environmental penalties in China. *Organization Science, 29*(5), 948–968.

Marquis, C., & Qiao, K. (2018). Waking from Mao's dream: Communist ideological imprinting and the internationalization of entrepreneurial ventures in China. *Administrative Science Quarterly, 0001839218792837*.

Marquis, C., & Tilcsik, A. (2013). Imprinting: Toward a multilevel theory. *Academy of Management Annals, 7*(1), 195–245.

Mattingly, J. E., & Berman, S. L. (2006). Measurement of corporate social action: Discovering taxonomy in the Kinder Lydenburg Domini ratings data. *Business & Society, 45*(1), 20–46.

Maung, M., Wilson, C., & Tang, X. (2016). Political connections and industrial pollution: Evidence based on state ownership and environmental levies in China. *Journal of Business Ethics, 138*(4), 649–659.

McEvily, B., Jaffee, J., & Tortoriello, M. (2012). Not all bridging ties are equal: Network imprinting and firm growth in the Nashville legal industry, 1933–1978. *Organization Science, 23*(2), 547–563.

Meng, X. H., Zeng, S. X., & Tam, C. M. (2013). From voluntarism to regulation: A study on ownership, economic performance and corporate environmental information disclosure in China. *Journal of Business Ethics, 116*(1), 217–232.

Mishina, Y., Dykes, B. J., Block, E. S., & Pollock, T. G. (2010). Why "good" firms do bad things: The effects of high aspirations, high expectations, and prominence on the incidence of corporate illegality. *Academy of Management Journal, 53*(4), 701–722.

Muller, A., & Kräussl, R. (2011). Doing good deeds in times of need: A strategic perspective on corporate disaster donations. *Strategic Management Journal, 32*, 911–929.

Nason, R. S., Bacq, S., & Gras, D. (2018). A behavioral theory of social performance: Social identity and stakeholder expectations. *Academy of Management Review, 43*(2), 259–283.

Oc, B. (2018). Contextual leadership: A systematic review of how contextual factors shape leadership and its outcomes. *The Leadership Quarterly., 29*(1), 218–235.

Osborn, R. N., Hunt, J. G., & Jauch, L. R. (2002). Toward a contextual theory of leadership. *The leadership quarterly, 13*(6), 797–837.

Pettigrew, T. F., & Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. *Journal of personality and social psychology, 90*(5), 751–783.

Porter, L. W., & McLaughlin, G. B. (2006). Leadership and the organizational context: Like the weather? *The Leadership Quarterly, 17*(6), 559–576.

Ref, O., & Shapira, Z. (2017). Entering new markets: The effect of performance feedback near aspiration and well below and above it. *Strategic Management Journal, 38*, 1416–1434.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1), 41–55.

Rubin, D. B. (2001). Using propensity scores to help design observational studies: Application to the tobacco litigation. *Health Services and Outcomes Research Methodology, 2*(3–4), 169–188.

Sajons, G. B. (2020). Estimating the causal effect of measured endogenous variables: A tutorial on experimentally randomized instrumental variables. *The Leadership Quarterly, 31*(5), 101348. https://doi.org/10.1016/j.leaqua.2019.101348.

Semadeni, M., Withers, M. C., & Trevis Certo, S. (2014). The perils of endogeneity and instrumental variables in strategy research: Understanding through simulations. *Strategic Management Journal, 35*(7), 1070–1079.

Shaver, J. M. (1998). Accounting for endogeneity when assessing strategy performance: Does entry mode choice affect FDI survival? *Management science, 44*(4), 571–585.

Shipman, J. E., Swanquist, Q. T., & Whited, R. L. (2017). Propensity score matching in accounting research. *The Accounting Review, 92*(1), 213–244.

Simsek, Z., Fox, B. C., & Heavey, C. (2015). "What's past is prologue" A framework, review, and future directions for organizational research on imprinting. *Journal of Management, 41*(1), 288–317.

Simpson, J., & Sariol, A. M. (2018). Squared Away: Veterans on the Board of Directors. *Journal of Business Ethics*, 1–11.

Snihur, Y., & Zott, C. (2020). The Genesis and Metamorphosis of Novelty Imprints: How Business Model Innovation Emerges in Young Ventures. *Academy of Management Journal., 63*(2), 554–583.

Stadelmann, D., Portmann, M., & Eichenberger, R. (2015). Military careers of politicians matter for national security policy. *Journal of Economic Behavior & Organization, 116*, 142–156.

Stinchcombe, A. L. (1965). Social structure and organizations. In J. G. March (Ed.), *Handbook of organizations* (pp. 142–193). Chicago, IL: Rand-McNally.

Strike, V. M., Gao, J., & Bansal, P. (2006). Being good while being bad: Social responsibility and the international diversification of US firms. *Journal of International Business Studies, 37*(6), 850–862.

Taylor, R. L. (2018). *Military leadership: In pursuit of excellence*. Routledge.

Tett, R. P., & Burnett, D. D. (2003). A personality trait-based interactionist model of job performance. *Journal of Applied Psychology, 88*(3), 500–517.

Tett, R. P., & Guterman, H. A. (2000). Situation trait relevance, trait expression, and cross-situational consistency: Testing a principle of trait activation. *Journal of Research in Personality, 34*(4), 397–423.

Tilcsik, A. (2014). Imprint–environment fit and performance: How organizational munificence at the time of hire affects subsequent job performance. *Administrative Science Quarterly, 59*(4), 639–668.

Wagner, U., Christ, O., Pettigrew, T. F., Stellmacher, J., & Wolf, C. (2006). Prejudice and minority proportion: Contact instead of threat effects. *Social psychology quarterly, 69*(4), 380–390.

Wang, D., Du, F., & Marquis, C. (2019). Defending Mao's dream: How politicians' ideological imprinting affects firms' political appointment in China. *Academy of Management Journal, 62*(4), 1111–1136.

Wang, R., Wijen, F., & Heugens, P. P. M. A. R. (2018). Government's green grip: Multifaceted state influence on corporate environmental actions in China. *Strategic Management Journal, 39*(2), 403–428.

Wansink, B., Payne, C. R., & van Ittersum, K. (2008). Profiling the heroic leader: Empirical lessons from combat-decorated veterans of World War II. *The Leadership Quarterly, 19*(5), 547–555.

Wong, C. W. Y., Miao, X., Cui, S., & Tang, Y. (2018). Impact of corporate environmental responsibility on operating income: Moderating role of regional disparities in China. *Journal of Business Ethics, 149*(2), 363–382.

Wong, L., Bliese, P., & McGurk, D. (2003). Military leadership: A context specific review. *The Leadership Quarterly, 14*(6), 657–692.

Xie, G., & Hao, Y. (2017). Military experience and corporate social responsibility: Evidence from China. Available at SSRN 3074269.

Zhang, L., Ren, S., Chen, X., Li, D., & Yin, D. (2018). CEO Hubris and Firm Pollution: State and Market Contingencies in a Transitional Economy. *Journal of Business Ethics*, 1–20.

Zhe Zhang (zhangzhe@mail.xjtu.edu.cn) is the professor of Organization Management at the School of Management, Xi'an Jiaotong University, China, where she also received her Ph.D. Her research focuses on public-private partnerships, human resource management and corporate social responsibility. She has published in the Human Relation, Human Resource Management, Management and Organization Review, International Journal of Human Resource Management, and International Journal of Health Care Finance and Economics.

Bingkun Zhang (dearzbk@163.com) is a PhD candidate of Faculty of Business and Economics, University of Hong Kong. His research focuses on corporate governance, corporate communication, and corporate social responsibility.

Ming Jia (jiaming@nwpu.edu.cn) is the professor of Organization Management at the School of Management, Northwestern Polytechnical University, China. He received his Ph.D from Xi'an Jiaotong University, China. His research focuses on corporate governance and corporate social responsibility. He has published in the Journal of Management Studies, Journal of Business Ethics, and International Journal of Human Resource Management.