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journal homepage: [www.elsevier.com/locate/jfec](http://www.elsevier.com/locate/jfec)Pilot CEOs and corporate innovation<sup>☆</sup>Jayanthi Sunder<sup>a</sup>, Shyam V. Sunder<sup>a</sup>, Jingjing Zhang<sup>b,\*</sup><sup>a</sup> Eller College of Management, University of Arizona, 1130 E Helen St., Tucson, AZ 85721, United States<sup>b</sup> Desautels Faculty of Management, McGill University, 1001 Sherbrooke West, Montreal, QC H3A 1G5, Canada

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## ABSTRACT

We find evidence that chief executive officers' (CEOs') hobby of flying airplanes is associated with significantly better innovation outcomes, measured by patents and citations, greater innovation effectiveness, and more diverse and original patents. We rule out alternative explanations, leading us to conclude that CEO pilot credentials capture the personality trait of sensation seeking. Sensation seeking combines risk taking with a desire to pursue novel experiences and has been associated with creativity. Our evidence highlights sensation seeking as a valuable personality trait that can be used to identify CEOs who are likely to drive innovation success.

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## 1. Introduction

Innovation is risky, unpredictable, long-term, multi-stage, labor intensive, and idiosyncratic, posing serious challenges to the design of incentive contracts (Holmstrom, 1989). Manso (2011) argues that standard

pay-for-performance schemes can be detrimental to innovation. Hellmann and Thiele (2011) also note that optimal incentives for standard tasks do not foster unplanned innovation. Further, through laboratory and field experiments, Glucksberg (1962), Ariely, Gneezy, Loewenstein, and Mazar (2009) and Ederer and Manso (2013) show that performance-contingent financial incentives inhibit creativity. Collectively, these studies highlight the limitations of conventional incentive schemes in motivating innovation. In this study, we examine the role of CEO personality traits on innovation and shed light on the effectiveness of using intrinsic rather than extrinsic motivation to encourage innovation.

Prior literature finds that overconfident CEOs who tend to take risks are positively associated with corporate innovation success (Galasso and Simcoe, 2011; Hirshleifer, Low, and Teoh, 2012). While risk taking is a necessary condition for innovation, it may not be sufficient. Studies in psychology have identified that openness to experience, one of the big five factors that define personality, is fundamental

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to creativity and innovation (Feist, 1998).<sup>1</sup> This insight is confirmed in a recent survey of 5,000 executives by Dyer, Gregersen, and Christensen (2011), who find that successful innovators are “constantly trying out new experiences and piloting new ideas.” Our study shows that CEOs who combine risk tolerance with a desire for new experiences achieve greater innovation success. We use CEOs’ revealed preference for flying small aircraft as a hobby to capture their innate desire for novel experiences that entail risk and find that pilot CEOs are associated with more successful and original innovation.

In the psychology literature, the desire to fly an airplane has been identified as one of the most important factors for predicting the thrill and adventure-seeking component of sensation seeking (Zuckerman, 1971; Zuckerman, Eysenck, and Eysenck, 1978). Sensation seeking is a personality construct, defined as “the seeking of varied, novel, complex and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risk for the sake of such experience” (Zuckerman, 1994, p. 27). More recently, Cain and McKeon (2016) employ pilot certification to proxy for CEO personal risk-taking. However, sensation seekers differ from pure risk takers because their willingness to tolerate risk stems from their desire to seek novel ideas and experiences (Zuckerman, 2007). Sensation seeking has been shown to be positively correlated with openness to experience (Roberti, 2004), and a number of studies find that sensation seekers are receptive to new ideas (e.g., Kish and Donnenwerth, 1969; Mittelstaedt, Grossbart, Curtis, and DeVere, 1976; Lopez-Bonilla and Lopez-Bonilla, 2012). Based on the research on sensation seeking, we expect that pilot CEOs are curious, creative, and open to new ideas, possessing the intrinsic motivation to pursue innovation.<sup>2</sup>

We hand collect CEOs’ pilot credentials using the airman certificate records from the Federal Aviation Administration (FAA). CEOs’ willingness to fly is unlikely to be affected by firm conditions because their decision to operate small aircraft as a hobby is made as a personal lifestyle choice. Thus, endogeneity is less of a concern in our study when using CEOs’ pilot certification as a measure of their personality trait to explain corporate behaviors. Our sample covers U.S. firms in innovative industries from 1993 to 2003.<sup>3</sup> During the sample period, we identify 88 pilot CEOs and 1,123 non-pilot CEOs. Our primary measures of innovation success are the number of patent applications filed during the year and the number of citations subsequently received by the patents applied during the year. Patent count and citation count are widely used proxies

for quantity and quality of innovation outcomes, respectively, in other studies including Hirshleifer, Low, and Teoh (2012), Atanassov (2013), and Seru (2014).

We find that CEOs’ hobby of flying small aircraft has a systematic relation with innovation activities in their firms. Firms led by pilot CEOs generate greater innovation outcomes, measured by patents and associated citations. The magnitude of the effect is statistically significant and economically large. In our regressions, we control for firm characteristics, year and industry fixed effects, and CEO characteristics, including age, human capital proxied by CEO tenure and academic achievement, explicit risk-taking incentives, military experience, and overconfidence. Our results are robust to additional controls and alternative subsamples, specifications, and measures of innovation.

We conjecture that pilot CEOs are successful at innovation because they are willing to spend more on innovation activities and/or they are more effective at innovation, given their tendency to be more creative and open to new ideas. We find that the coefficient estimate of pilot CEOs on research and development (R&D) spending is positive and large, but it is not statistically significant, suggesting significant variation in firm R&D input among pilot CEOs. However, controlling for the level of innovation input (R&D spending), pilot CEOs are associated with greater innovation success. The results imply that pilot CEOs achieve success through innovation effectiveness. In contrast, CEOs with higher explicit risk incentives, proxied by vega of their stock options, invest more in R&D. But once we account for R&D spending, higher vega does not incrementally translate to better innovation outcomes.

Further, to the extent that pilot credentials capture the CEO’s openness to new ideas and experiences, we conjecture that patents generated by pilot CEOs span diverse technology fields compared to non-pilot CEOs. Consistent with this prediction, we find that firms with pilot CEOs pursue more diverse and original innovation projects and their patents generate higher market reactions around the patent grant date. These results are even stronger in a subsample of innovative firms, where firms incur positive R&D expenditure during the sample period. At the same time, vega is not associated with originality, or market reactions of the patents and is only weakly related to diversity. The contrasting results between pilot CEOs and vega support the idea that the personality trait proxied by pilot credentials goes beyond risk taking. Overall, the results suggest that, while extrinsic motivation from compensation contracts can result in higher innovation spending, intrinsic motivation of pilot CEOs can be more effective in generating valuable and original innovation.

Common to studies examining CEO characteristics, there are two distinct but related interpretations of our results, i.e., imprinting and matching. Pilot CEOs are able to exert direct influence on the firm’s innovation activities. Alternatively, firms that value innovation may choose to hire pilot CEOs who possess desirable personality traits. Matching is not inconsistent with imprinting because firms may appoint pilot CEOs with the expectation that they are able to drive corporate innovation. We examine changes in the patent and citation counts around CEO turnovers and find that, keeping the firm constant, pilot CEOs are

<sup>1</sup> The other four factors are conscientiousness, extraversion, agreeableness, and neuroticism.

<sup>2</sup> Anecdotal evidence suggests a link between the CEO’s decision to fly planes and corporate innovation. Micron Technology Inc. is a highly innovative technology firm that manufactures advanced semiconductor products. Steven Appleton, the former CEO of Micron, was actively engaged in flying, among other risky sports. He died in 2012 when his plane crashed during takeoff (see “Executive no-fly zone? Boards grapple with CEOs that fly own planes; Balancing ‘freedoms’,” *Wall Street Journal*, March 14, 2012).

<sup>3</sup> We end our sample period in 2003 in order to measure subsequent citations of patents through 2006. We discuss the sample period in detail in Section 3.

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