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The nexus of top executives' attributes, firm strategies, and outcomes: Large firms versus SMEs

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Based on a unique and extensive dataset of top executives, this study explores the effect of top executives' attributes on firm performance through strategic choices for capital structure and investments. The big five personalities and top executives' other four essential personal attributes are identified from over 970,000 observations in Japanese firms. We applied structural equation modeling to test the hypothesized mediation models and the differences across large, medium, and small-sized firms. The results show that top executives in small and medium-sized enterprises (SMEs) present stronger linkages with strategic choices, significantly mediating the relationship between top executives' attributes and firm performance. Specifically, top executives with higher *conscientiousness*, *decisiveness*, and *financial prudence* tend to choose conservative strategies, while those with higher *neuroticism*, *openness*, and *agreeableness* tend to adopt risky and innovative strategies. In contrast, top executives' attributes can hardly predict firm strategies and outcomes for large firms, and neither fails to predict firm outcomes in SMEs given the inconsistent mediation.

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Introduction

Does the top executive matter for strategic decision-making and organizational performance outcomes? Which attributes of the top executive matter? When and to what extent does the top executive matter? These long-discussed questions have attracted much attention from business practitioners and scholars. Since upper echelons theory (UET) was first introduced by Hambrick and Mason (1984), empirical studies have provided growing evidence on the impacts of top managers and proved the critical role of top managers in both strategic choices and performance (Wang et al., 2016). Demographic factors of top executives are usually used to indicate top executives' attributes, such as their educational background, tenures, career experiences, etc. For example, in terms of corporate strategy, behavioral consistency is found to exist between the top manager's personal leverage preference and corporate leverage (Cronqvist et al., 2012; Korkeamäki et al., 2017). The technology-related education or experiences of top executives influence the R&D investment in the firms they lead (Barker and Mueller, 2002) and further impact the firms' innovation (Custódio et al., 2019; Tabesh et al., 2019). However, given the "black box problem" that demographic factors are insufficient to explain executive behavior (Lawrence, 1997), the use of demographic factors may result in imprecise estimations (Hambrick, 2007). Against this issue, studies have used psychological data on top managers (Gow et al., 2016; Kaplan et al., 2012) to provide more detailed evidence of the effect of top executives. Nonetheless, small organizations are reluctant to provide the personal data of their senior executives. Most studies that use psychological data focus on large firms, and studies on small and medium-sized enterprises (SMEs) remain limited even though SMEs cover a wider range of economic activities.

Studies of managerial discretion suggested that the degree of the top executive's impact on firm strategy and outcomes varies by the task environment, the organization, and the executive's characteristics (Hambrick and Finkelstein, 1987). The macro-level lens suggests cultural context plays a vital role in determining the CEO's managerial discretion. For example, Japanese firms' management practices are traditionally opposed to Western management models, typically the US management model (Pudelko, 2009). Cross-national comparative studies have estimated managerial discretion in different cultural contexts, indicating that managerial discretion is higher in US firms than in German and Japanese firms (Crossland and Hambrick, 2007). Japan is found to have the lowest performance effects among the 15 investigated developed countries (Crossland and Hambrick, 2011). However, these findings only based on large firms may generate misleading implications of top executives' impacts. Top executives in smaller organizations may have more substantial effects (Hannan and Freeman, 1984) than those in larger organizations. The relationship between firm size and managerial discretion is still in question (Cortes and Kiss, 2023). Following the managerial discretion perspective, studying the heterogeneity of large firms and SMEs will deepen the understanding of which factors and to what extent top executives impact corporate strategy and outcomes. Japanese firms, traditionally thought to have a lower CEO impact, can be a typical example of how CEO impacts differ across large firms and SMEs. Furthermore, managerial discretion varies across corporate strategies (Wangrow et al., 2015). Theoretically, strategic choices are supposed to mediate the relationship between top executives and firm performance (Liu et al., 2018). Empirical studies have also suggested the mediating effects of strategic change and flexibility in the relationship between top executives' attributes and firm outcomes among SMEs (Herrmann and Nadkarni, 2014; Nadkarni and Herrmann, 2010). Still, there are few comparative studies on large firms and SMEs.

This study attempts to fill the void by conducting an in-depth investigation of the top executive's attributes and the distinct effects of the top executive's attributes across large firms and SMEs. Based on a unique corporate credit survey dataset of over 970,000 top executives in Japanese firms and from 25 indicators of top executives' characteristics, we summarized 9 primary factors, including the big five personalities *conscientiousness*, *extraversion*, *neuroticism*, *openness*, *agreeableness*, and four executive's attributes *uniqueness*, *execution skills*, *decisiveness*, *financial prudence*. We built a mediation model to examine the impacts of top executives on firm performance through top executives' strategic choices regarding financial leverage and R&D investment. A representative sample of Japanese corporations, including large firms and SMEs, is constructed to test the difference in top executives' effects across large firms and SMEs.

The main findings are as follows. First, top executives with high *conscientiousness*, *decisiveness*, and *financial prudence* are more likely to have a conservative financial strategy, while top executives with high *neuroticism*, *openness*, and *agreeableness* tend to take more financial risks. Top executives' openness is an important factor associated with R&D investment. Second, strategic choices, especially financial leverage, significantly mediate the relationships between most top executives' attributes and firm performance. The path through financial leverage is found to have stronger effects than R&D investment. Third, the effects of several top executives' attributes on strategic choices significantly vary across large firms and SMEs. In small firms, the impacts of the top executive's attributes on strategic choices will be much stronger than those in larger firms. Top executives with high *openness* strongly impact both financial leverage and R&D intensity. Given the significant indirect effects of top executives' attributes in SMEs, it is difficult to reconcile the weak impact of top executives in Japanese firms. Even though the top executive's attributes cannot be directly linked to the firm's short-term performance, these attributes have significant indirect effects on financial outcomes through strategic choices. Our results further suggest that inconsistent mediation exists for most top executives' attributes than for indirect effects, which may explain the previous low-performance effects in Japanese firms.

This study contributes to the existing literature in several ways. First, this study provides multidimensional measures of top executives' attributes by considering both personality and management skills based on a large dataset of top executives. This study shows a more comprehensive view of the CEO impacts by distinguishing the impacts of personality and management skills and identifying several vital factors associated with strategic choices. Second, the effects of top executives' attributes vary across large firms and SMEs, providing insights into the subtle patterns of managerial discretion. The existing literature usually focuses on large firms, while the findings in this study extend to SMEs, suggesting a stronger role of top executives in small firms. Third, the mediating effects through strategic choices offer new insight into the role of top executives. As suggested in previous studies, top executives' performance effect is relatively lower in Japanese firms than in other countries. However, our findings indicate a strong association between top executives and strategic choices, offering a complementary explanation regarding the managerial discretion of top executives in Japan. This study's findings will provide practical suggestions for firms operating in Japan and offer a basis for further cross-national comparative studies.

The rest of the paper proceeds as follows. Section "Theoretical background" reviews UET and previous studies on managerial discretion. Section "Sample and measures" describes the sample used in this study and measures the characteristics of top

executives, financial variables, and other firm characteristics. Section “Method” introduces the method to estimate the mediation models and the contextual influence of firm types. We report the results in the section “Results”. Then, we discuss the results in the section “Discussion” and conclude in the section “Conclusion”.

Theoretical background

Upper echelons theory. For an organization, upper echelon theory suggests that strategic choices or outcomes can reflect the values and cognitive bases of powerful actors in the organization: the top executive (Hambrick and Mason, 1984). The top executive’s perceived interpretation of the objective situation may influence the strategic decision-making process and, therefore, the firm’s performance. It is supposed that the effects of the top executive can be directly translated into organizational outcomes or affect firm performance through strategic choices (Liu et al., 2018). On the other hand, the top executive’s attributes also play a moderating role in the relationship between corporate sustainability and financial performance (Lin et al., 2022). Many empirical studies have estimated the effect of top executives and proved that top executives matter in several respects (G. Wang et al., 2016). Specifically, Cronqvist et al. (2012) found an association between CEOs’ personal leverage and corporate financial leverage in US firms. Similar evidence has also been found in firms in Finland (Korkeamäki et al., 2017), implying that the personal financial preference of top executives may affect corporate financial policy. For R&D spending, firms with top executives who hold science-related degrees or experience tend to increase R&D spending (Barker and Mueller, 2002). Furthermore, Gow et al. (2016) documented a holistic picture of the relationship between CEOs’ personalities, firm policies, and performance.

In the existing literature, several types of indicators are used for top executives’ attributes to test their effects on corporate strategy and performance. First, top manager fixed effects are used to test whether the top managers matter and the extent to which they matter. For example, Bertrand and Schoar (2003) found that variations in corporate strategies are associated with heterogeneities among managers, which are further linked to different managerial characteristics. Crossland and Hambrick (2007, 2011) compared nation-level managerial discretion by analyzing top manager fixed effects. Hambrick and Quigley (2014) estimated CEO fixed effects and validated this measurement with industry discretion. Second, demographic factors of top executives are used to illustrate further which kinds of features of the top executive matter for certain strategic choices and firm performance. According to upper echelons theory, the personal perception of an objective situation is a function of the top executive’s experience, value, and personality, and numerous empirical findings suggest that although incomplete and imprecise, using the observable variables of top executives such as age, educational background, and experience is valid to predict corporate actions (Hambrick, 2007). For instance, military or pilot experience (Benmelech and Frydman, 2015; Cain and McKeon, 2016) and marital status (Roussanov and Savor, 2014) are used to test the effects on corporate risk, given that personal risk preference could be highly related to these experiences. Work experiences, such as acquisition experience (Field and Mkrtchyan, 2017), generalist or specialist experience (Gounopoulos and Pham, 2018), and the skill set of directors (Adams et al., 2018), are also widely used as a proxy to predict corresponding strategy and performance. However, there is a “black box problem” when using demographic factors due to the lack of direct assessment of the psychological features of top executives (Lawrence, 1997). Through in-depth surveys and content analysis, psychological

data on top executives become available, which can provide more precise estimations of the effects of top executives. For example, CEO overconfidence (Huang and Kisgen, 2013; Malmendier and Tate, 2005, 2015) and CEO narcissism (Chatterjee and Hambrick, 2011) are used to investigate how corporate risk is affected by top executives. Kaplan et al. (2012) analyzed 30 individual characteristics of CEO candidates and found that general ability and execution skills are linked to better performance outcomes. Gow et al. (2016) assessed top executives’ Big Five personality traits and explored their relationship with firm policies and performance. Nevertheless, few studies use psychological data due to the difficulty of collecting personal psychological data on senior executives.

Managerial discretion. The empirical results on the effects of top executives on performance indicate that there is often inconsistency in the degree of these effects. One possible reason is the estimation bias that occurs when using demographic indicators that could be unreliable, given the complexity of personal values and cognitive bases (Hambrick and Mason, 1984). The more important reason is thought to be the contextual influence on the managerial discretion of the top executive, which is defined as the latitude of action by which the top executive can influence decision-making and the level of discretion that can alter across environmental conditions, organizations, and individual psychological characteristics (Hambrick, 2007; Hambrick and Finkelstein, 1987).

For macro-level conditions, cultural values change across nations, implying that to some extent, the values of managers and leaders could be influenced by different cultural contexts (Gelfand et al., 2011), thus leading to multidimensional heterogeneities in managerial leadership (Javidan and Dastmalchian, 2009). Based on the UET, Geletkanycz (1997) suggested a significant effect of cultural values on executives’ attitudes toward strategic change. Crossland and Hambrick (2011) investigated 15 countries involved in world business and suggested that the degree of country-level managerial discretion is related to certain informal and formal national institutions. Furthermore, the level of discretion is reflected in the degree of the CEO’s performance effects, suggesting that Japanese firms have the lowest managerial discretion, which is consistent with the findings of previous work (Crossland and Hambrick, 2007). Specifically, the features of Japanese society that are characterized as collectivist include relatively high cultural tightness (Gelfand et al., 2011), high power distance, and uncertainty avoidance (Geert et al., 2010). These contextual and cultural factors may lead to limited managerial discretion in Japanese firms.

In terms of micro-level conditions, the levels of managerial discretion may also vary across firm types and top executives’ psychological characteristics (Wangrow et al., 2015). From the perspective of population ecology, larger or older firms may face strong inertial forces that limit organizational change (Hannan and Freeman, 1984); in other words, there are fewer changes the top executive can enforce in an organization (Hambrick and Finkelstein, 1987). In contrast, in SMEs, top executives, who often serve as both owners and managers, may possess more power in strategy formulation and implementation than their counterparts in large firms (Finkelstein and Hambrick, 1996). Top executives’ management approaches and philosophies are also found to differ between family firms and public firms, and these differences are stable across nations (Mullins and Schoar, 2016). Moreover, as suggested by Wangrow et al. (2015), managerial discretion could also change across different types of firm strategies that are decided by the top executive. Studies on SMEs emphasize the critical role of strategic change and flexibility in mediating the

relationship between the top executive's personality and firm outcomes (Herrmann and Nadkarni, 2014; Nadkarni and Herrmann, 2010).

To date, there is still limited exploration about the effects of specific top executives' characteristics and how the effects differ at the organizational level due to the difficulty of collecting personal psychological data on senior executives in SMEs. Studies on top executives in Japanese firms usually use samples of public firms, leaving the situation of SMEs unknown. Following the UET and the findings on managerial discretion in prior studies, top executives' effects on SMEs are expected to be stronger, especially in small firms, than in large firms. Furthermore, given the mediating effect of firm strategies, this study introduced financial leverage and R&D investment as mediators to examine the impacts of top executives on firm performance and how these relationships change across different firm types, including large firms and SMEs. We hypothesize that the impacts of the top executive's attributes are stronger in SMEs than in large firms in terms of strategic choices and firm outcomes.

Sample and measures

Top executives' attributes. We constructed the sample from a unique database provided by Teikoku Databank Ltd., one of Japan's largest corporate credit research companies. On-site research was conducted to gather accurate information about the target firms, including public firms and a large number of unlisted firms. The assessment of top executives was conducted by professionally trained researchers based on interviews with the top executives and the management team and confirmation from the head office. The top executive in this study refers to the firm's president, usually the representative director (*shacho*, or *daihyo-torishimariyaku*) of a Japanese firm. We obtained 970,206 observations from the year 1985–2014 in the database¹. As shown in Table 1, 25 indicators of personal attributes for each top executive are assessed, including indicators that describe individual characteristics such as seriousness, steadiness, tolerance, kindness, and indicators of management skills such as execution skills, extraversion, and technology orientation.²

We applied exploratory factor analysis for the 25 indicators of top executives' attributes to summarize the main factors that were used to conduct further research. To determine the optimal factor numbers, we used parallel analysis (Horn, 1965), and the results show that based on our dataset, the optimal number of factors is 9 (see Supplementary Information Fig. S1). Table 2 reports the loadings on the 9 factors, and Fig. 1 illustrates the correlation and distribution of these factors. Given that factors could be correlated with each other, oblimin rotation is used to determine the most interpretable factor loading solution³. In Table 2, the 9 factors are listed in decreasing order of the proportion of variance explained. Based on the factor loadings, we summarized the big five personality factors (Goldberg, 1990) and the other four factors below to illustrate the top executive's attributes.

Conscientiousness. *Conscientiousness* is described as hard-working, dependability, dutifulness, and putting things in order (John and Srivasta, 1999; Judge et al., 2002). As for CEOs, a high level of conscientiousness is also associated with a culture of rule-oriented and precision (O'Reilly et al., 2014). Conscientious individuals are more likely to emerge as leaders (Judge et al., 2002). In our results, the first factor explained 19% of the variance, with positive loadings on serious, steady, and responsibility, which is consistent with the features of conscientiousness. Studies on a sample of college students and communities found that *conscientiousness* in Japan is lower than that in most other countries (Chopik and Kitayama, 2018; Schmitt et al., 2007). However,

Table 1 Descriptions of top executives' characteristics.

Characteristics	Description
Prudent	Thinks carefully without arbitrary decision
Tolerance	Is capacious and patient to accept others without criticism
Charismatic	Is attractive and trusted by subordinates
Proactive	Is self-directed and acts positively
Persistence	Presents tenacity and obstinacy
Responsibility	If of strong responsibility on work
Technology-oriented	Always follows up the state-of-art technologies and takes them into the business
Creative	Brings original and innovative ideas
Steady	Is dependable and maintains stable performance
Foresight	Is good at anticipating the future
Strategic vision	Holds a big picture for current and future situations
Serious	Is earnest and hard-working
Attention to detail	Is precise about details
Disorganized	Plans, organizes, and schedules inefficiently
Kindness	Respects others and takes care of the others' feelings
Network	Possesses a wide range of personal connections
Fast	Responds and takes action quickly
Execution	Can get things done in timely
Thrifty	Is financially severe
Sociable	Is willing to communicate with others on various occasions
Oral communication	Speaks clearly, succinctly, and persuasively
Strategic planning	Manages projects smoothly and efficiently
Decisiveness	Makes sound decisions
Openhearted	Is open-minded and easygoing
Unique	Is distinctive

different from the general population, over half of the top executives in our sample have a relatively higher *conscientiousness* score (see Fig. 1b), indicating that top executives' *conscientiousness* is highly valued in the context of Japanese business.

As for strategic choices, highly conscientious managers are likely to avoid uncertainty and stick to rules with specific performance feedback rather than adapting to changing environments (Nadkarni and Herrmann, 2010). Conscientious CEOs are also less interested in innovative culture (O'Reilly et al., 2014). Therefore, firms under the management of conscientious executives are expected to take lower financial risks and conduct less innovative activities.

Extraversion. *Extraversion* is associated with sociability, articulation, and expressiveness (John and Srivasta, 1999; Judge et al., 2002; Judge and Bono, 2000). Extraverted CEOs are more likely to be optimistic, sociable, and customer-oriented (O'Reilly et al., 2014). In our results, the third factor shows the features of *extraversion* with positive factor loadings on sociable, oral communication, and network.

Studies found that *extraversion* positively predicts transformational leadership (Bono and Judge, 2004; Judge and Bono, 2000) and leader emergence and leadership effectiveness (Judge et al., 2002), which is expected to lead to better outcomes. However, due to the lack of receptivity to upward influence, the advantage of *extraversion* on leadership effectiveness is only found in the group of passive subordinates and employees (Grant et al., 2011). In terms of firm strategies, the sociability, and network of extravert CEOs allow them to expose to new information and reduce selective perception and interpretation biases, which lead to higher strategic flexibility in a changing context (Nadkarni and Herrmann, 2010), particularly the initiation of strategic change

Table 2 Factor loadings.

	Conscientiousness	Uniqueness	Extraversion	Execution skills	Neuroticism	Openness	Decisiveness	Agreeableness	Financial prudence
Proportion explained	0.19	0.13	0.12	0.12	0.11	0.10	0.09	0.08	0.05
Cumulative proportion	0.19	0.32	0.44	0.56	0.67	0.77	0.87	0.95	1.00
Prudent					-0.1				0.2
Tolerance								0.25	
Charismatic							0.18		
Proactive				0.20	0.40				
Persistence		0.29							
Responsibility	0.15			0.18				0.16	
Technology-oriented			-0.10				0.17	0.10	
Creative		0.19					0.17		
Steady	0.41				-0.15				
Foresight							0.13	0.30	
Strategic vision							0.22	0.16	
Serious	0.67								
Attention to detail									0.19
Disorganized		0.12							
Kindness								0.41	
Network			0.23					0.11	
Fast					0.35				
Execution				0.51					
Thrifty									0.28
Sociable			0.46						
Oral communication			0.29						
Strategic planning				0.11			0.39		
Decisiveness				0.10				0.31	
Openhearted		0.12							
Unique		0.54							

The total number of observations is 970,206 top executives. Parallel analysis shows that the optimal number of factors is 9. An exploratory factor analysis model with an oblimin rotation is used here. Values of factor loadings <0.1 are omitted.

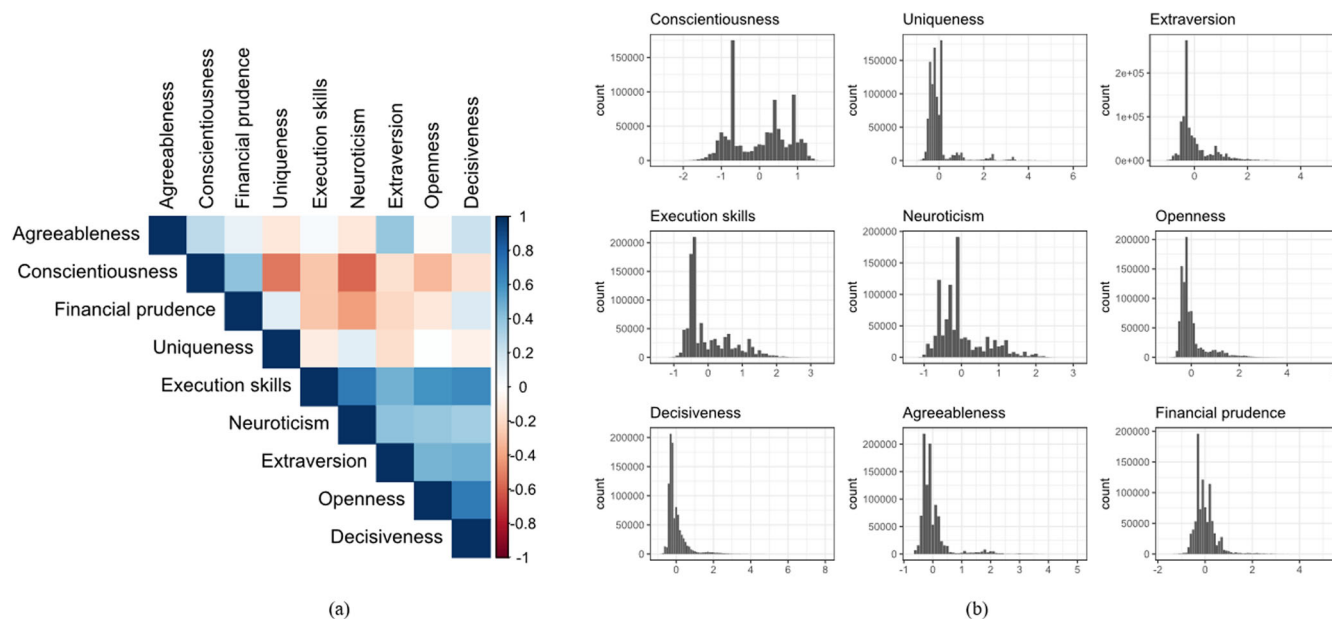


Fig. 1 The correlations and distributions of the 9 top executive characteristics. a The correlations between the 9 top executive characteristics. **b** The distributions of the 9 top executive characteristics.

(Herrmann and Nadkarni, 2014). Although *extraversion* is associated with optimism and risk-taking, in the work of Gow et al. (2016), no evidence showed that *extraversion* is related to the high level of financial risk and innovative firm policies. Together, the relationship between *extraversion*, firm strategies, and firm performance remains unclear.

Neuroticism. *Neuroticism* describes the degree of emotional stability and is found to be negatively related to leader emergence

(Judge et al., 2002). High neuroticism is more likely to result in depression and anxiety (Nettle, 2006), which is undesirable in CEOs. However, it is found that neuroticism has a protective function in extremely dangerous situations, even though it can hardly be detected in contemporary human society (Nettle, 2006). Other studies suggested that neuroticism could also be positively associated with competitiveness (Ross et al., 2001), whereas the benefits of neuroticism depend on interactions with other factors (Nettle, 2006). Generally, people with low *neuroticism* are more

flexible, adaptable, and can focus on changing contexts (Wiggins, 1996). At the managerial level, this ability allows CEOs to initiate strategy changes and keep higher strategy flexibility (Herrmann and Nadkarni, 2014; Nadkarni and Herrmann, 2010).

In our results, the fifth factor has negative loadings on steady and positive loadings on proactive and fast. Furthermore, it is negatively related to *conscientiousness* (see Fig. 1a). These combined features illustrate the instability of top executives in behaviors and performance.

Openness. Individuals scoring high in *openness* tend to be imaginative, intelligent, creative, insightful, and curious (John and Srivasta, 1999). At the managerial level, *openness* is associated with transformational leadership (Judge and Bono, 2000), and leaders who have a high score on openness are more likely to see a vision for the organization's long-term development (Bono and Judge, 2004). CEOs with higher openness are also more likely to be associated with adaptability cultures that value innovation, speed, experimentation, and risk-taking (O'Reilly et al., 2014).

The sixth factor in our results has positive loadings on strategic planning, strategic vision, technology-oriented, creative, foresight, and attention to detail, which indicate the level of *openness*. Here, we predict that *openness* is expected to be positively related to innovative activities and financial risk.

Agreeableness. *Agreeableness* is thought to be sympathetic, kind, appreciative, and soft-hearted (John and Srivasta, 1999). Individuals that score high on *agreeableness* have the intention to avoid conflict and strive for communion with others, while this feature is not associated with better performance (Barrick et al., 2002). At the managerial level, CEOs who have higher scores on *agreeableness* tend to create cultures that are less competitive and result-oriented (O'Reilly et al., 2014) and are more likely to have transformational leadership (Judge and Bono, 2000). However, *agreeableness* has no significant linkage with leadership effectiveness (Judge et al., 2002) and did not predict executive career success (Boudreau et al., 2001). The relationship between agreeableness and firm strategic choices is found to be complex and presents a non-linear relationship (Nadkarni and Herrmann, 2010). Previous studies have no solid evidence to clarify the association between agreeableness and firm strategies (Benischke et al., 2019). In our results, the eighth factor reflects the features of *agreeableness* with positive loadings on kindness, tolerance, and responsibility, which is consistent with the definition of agreeableness.

Uniqueness. Besides the big five factors, the other four factors are summarized to illustrate the top executives' attributes. *Uniqueness* has positive loadings on unique, persistence, creative, open-hearted, and disorganized, indicating a negative correlation with *conscientiousness* (see Fig. 1a). *Uniqueness* is a universal human desire to be distinct from others, which is supposed to be beneficial for both individual and social diversity, despite the extremely bad cases (Lynn and Snyder, 2002; Snyder and Fromkin, 1977; Vignoles, 2009). Studies noted the positive effects of *uniqueness* on personal happiness (Koydemir et al., 2014), and uniqueness-seeking is expected to have creative thinking and produce new ideas and skills that may challenge the "business as usual" routines (Schumpe and Erb, 2015). Thus, a higher score for *uniqueness* implies that the person sticks less to regular plans but is better at creative tasks.

Execution skills. The fourth factors capture 12% of the variance. *Execution skills* have positive loadings on execution, proactive, responsibility, strategic planning, and decisiveness. This factor is in line with the factor of focus in the study of Kaplan et al. (2012),

extracted from 30 indicators of CEO characteristics, in which *execution skills* are found to relate to better subsequent performance positively.

Decisiveness. The seventh factor, *decisiveness*, which explains 9% of the variance, has positive loadings on decisiveness, foresight, charismatic, strategic vision, and network and serves as an indicator to capture the integrative competence to judge a situation and make decisions in the long run. *Decisiveness* is one of five essential attributes facilitating outstanding leadership (Brodbeck et al., 2000), associating favorable effects on human resource management and strategic decision-making. Mulki et al. (2012) documented that the subordinate's felt stress could be alleviated with a higher decisiveness manager, which avoids potential turnover. In our results, *decisiveness* is found to be positively related to *execution skills* and *openness*.

Financial prudence. The last factor, named *financial prudence*, has positive loadings on thrifty, prudent, and attention to detail, which can serve as a predictor of a top manager's personal financial preferences. Previous studies suggested a strong linkage between CEO's personal financial preference and firm financial strategies. A study on US companies used the personal leverage level of CEOs' recent home purchases as an indicator to predict firm financial leverage (Cronqvist et al., 2012). Similar results are also found in Finland firms, showing that the top manager's personal leverage preference is consistent with corporate leverage (Korkeamäki et al., 2017). Therefore, we suppose that high financial prudence relates to low financial leverage in Japanese firms.

Financial and firm characteristic variables. All financial data are collected within one-year after the survey on top executives' attributes. After dropping missing values and observations from the financial sector and other sectors with fewer than 10 firms (forestry and fisheries), we obtained a pooled cross-sectional sample with 85,175 observations from 2010 to 2014⁴. ROA, an accounting-based measure, is used as an indicator of corporate financial performance and calculated as the ratio of net income to total assets. Given that most SMEs in our sample are unlisted firms, market-based performance measures are not included.

Firm strategic actions investigated in the existing literature can be classified into three categories: strategic scope, strategic risk, and strategic change (Wang et al., 2016). SMEs, usually domestic and local firms with limited market and resources, can hardly conduct actions on the strategic scope or change as large firms. Strategic risk turns out to be the common issue that is available for comparing the impact of top executives across large firms and SMEs. Financial leverage and R&D spending are the most-used indicators to construct corporate strategic risk associated with firm performance (Cain and McKeon, 2016; Chatterjee and Hambrick, 2011; Devers et al., 2008; Iqbal et al., 2022), and are controllable by the top executives (Chatterjee and Hambrick, 2007). Thus, we use these two measurements as mediators between the top executives and firm performance. Financial leverage is calculated as the ratio of total liabilities minus cash to total assets. R&D spending is proxied by R&D intensity (R&D expenditure divided by revenue), and the missing values are set to zero.

Firm characteristics consist of firm size (the logarithm of total assets), profitability (one-year lagged ROA), historical revenue growth (average revenue growth rate in the past three years), firm age, tangibility (ratio of fixed tangible assets to total assets), and capital intensity (the logarithm of the ratio of fixed tangible assets to the number of employees). The descriptive statistics are shown in Table 3.

Table 3 Descriptive statistics and correlations.

Variables	Mean	Std.	CON	UNI	EXE	INT	PRO	TEC	DEC	AGR	FIN	ROA	LEV	RD	Fsize	FAGE	PROF	SAL	TAN	CAP
Conscientiousness	0.15	0.74	1.00																	
Uniqueness	-0.14	0.49	-0.52	1.00																
Execution skills	0.17	0.74	-0.39	-0.05	1.00															
Extraversion	0.10	0.65	-0.25	-0.14	0.47	1.00														
Neuroticism	0.07	0.71	-0.64	0.17	0.71	0.42	1.00													
Openness	0.08	0.66	-0.38	0.02	0.60	0.46	0.40	1.00												
Decisiveness	0.15	0.71	-0.25	-0.04	0.63	0.46	0.36	0.70	1.00											
Agreeableness	0.07	0.58	0.22	-0.14	0.05	0.38	-0.12	-0.01	0.23	1.00										
Financial prudence	0.04	0.50	0.40	0.09	-0.27	-0.19	-0.39	-0.09	0.19	0.10	1.00									
ROA (%)	1.55	9.08	-0.01	0.00	0.01	0.00	0.01	0.01	0.01	-0.01	0.00	1.00								
Financial leverage (%)	51.39	47.85	-0.05	0.02	0.03	0.05	0.06	0.02	-0.01	0.03	-0.07	-0.31	1.00							
R&D intensity (%)	0.20	1.88	-0.02	0.00	0.01	0.00	0.01	0.06	0.02	-0.01	-0.01	-0.05	0.01	1.00						
Firm size	13.49	1.70	-0.07	-0.03	0.08	0.00	0.04	0.06	0.11	-0.05	0.00	0.10	-0.18	0.04	1.00					
Firm age	36.54	18.89	0.11	-0.06	-0.10	-0.08	-0.12	-0.13	-0.05	0.01	0.09	-0.01	-0.12	-0.01	0.47	1.00				
Profitability (%)	1.02	9.47	-0.01	-0.01	0.02	0.01	0.01	0.02	0.02	-0.01	0.00	0.22	-0.31	-0.03	0.12	-0.01	1.00			
Sales growth (%)	9.51	27.29	-0.05	0.01	0.03	0.03	0.04	0.05	0.02	-0.02	-0.04	0.11	0.02	0.00	-0.08	-0.20	0.06	1.00		
Tangibility (%)	25.26	21.27	0.01	0.02	0.00	-0.01	0.02	-0.03	0.00	0.02	0.01	-0.06	0.16	-0.02	0.15	0.14	-0.03	-0.09	1.00	
Capital intensity	8.23	1.86	0.01	0.01	0.01	0.00	0.02	-0.03	0.02	0.01	0.03	-0.01	0.02	-0.01	0.41	0.33	0.02	-0.08	0.69	1.00

Values of financial indicators, including ROA, financial leverage, R&D intensity, profitability (one-year lagged ROA), sales growth, and tangibility, are shown as percentage points. These financial indicators are winsorized at 0.5% and 99.5% levels before matching with the top executive attribute data.

Here, we distinguish large, medium-sized, and small firms according to each company’s capital and regular workforce, following the definition of SMEs in Japan’s Small and Medium-sized Enterprise Basic Act. 93.58% of the sample consists of small and medium-sized firms, of which 57.10% are medium-sized companies and 36.48% are small companies⁵.

Method

We applied structural equation modeling (SEM) to test the mediation models and the differences across firm types, as shown in Fig. 2 (Finch and French, 2015). The model specification is shown in Eqs. (1)–(3). Equation (1) estimates the path from the top executive’s attributes, denoted by Factor_{fi} (f = 1, ..., 9), to firm performance, denoted by ROA_i, and the path from the mediators (financial leverage, denoted by Leverage_i, and R&D intensity, denoted by RD_i) to firm performance. Equations (2) and (3) estimate the path from the top executive’s attributes to financial leverage and R&D intensity, respectively. In each equation, X_{ci} denotes the corresponding control variables. All the equations control for the sector, financial year, firm location, and the dummy variable indicating whether the firm is listed or not. Specifically, in Eq. (1), the model also controls for firm size, firm age, historical revenue growth, and capital intensity. In Eq. (2), we follow prior studies and control for firm size, profitability, tangibility (Cronqvist et al., 2012; Frank and Goyal, 2009; Korkeamäki et al., 2017), and firm age, which is considered an essential factor for financial leverage (Kieschnick and Moussawi, 2018). Following prior studies on R&D investment (Barker and Mueller, 2002), the control variables in Eq. (3) include firm size, firm age, past performance proxied by historical revenue growth, and capital intensity (Custódio et al., 2019). In addition, the dummy variable of missing R&D is used to control for the missing value of R&D intensity.

$$ROA_i = \beta_{p,0} + \beta_{p,f_i}Factor_{f_i} + \beta_{p,lev}Leverage_i + \beta_{p,rd}RD_i + \beta_{p,c}X_{ci} + \epsilon_{p,i} \tag{1}$$

$$Leverage_i = \beta_{L,0} + \beta_{L,f_i}Factor_{f_i} + \beta_{L,c}X_{ci} + \epsilon_{L,i} \tag{2}$$

$$RD_i = \beta_{R,0} + \beta_{R,f_i}Factor_{f_i} + \beta_{R,c}X_{ci} + \epsilon_{R,i} \tag{3}$$

Results

The goodness of fit of the model. We first run the model on the full sample and then rerun the model on the subsamples of large, medium-sized, and small firms. Given that the observed variables violate the multivariate normal distribution, all the models are estimated by using the diagonally weighted least squares (DWLS) approach⁶ (Li, 2016). As shown in Table 4, we used the following indices to assess the model fit: the comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR)⁷. Following the goodness of fit criterion (Hu and Bentler, 1999; Kline, 2015), although the TLI values are relatively lower than the cutoff value, in general, all the other indices suggest that the models fit the data well.

Estimation results. Tables 5–7 present the estimation results for the full sample and three subsamples. First, both financial leverage and R&D intensity are found to be negatively related to ROA and consistent across different firm types (see Table 5). For the top executive’s characteristics, the results for the full sample show that *neuroticism* (b = 0.223, p = 0.002) and *agreeableness* (b = 0.27, p = 0.000) have positive effects on ROA, while *decisiveness* (b = -0.186, p = 0.01) is negatively related to ROA. The results of the subsamples show distinct effects across firm types.

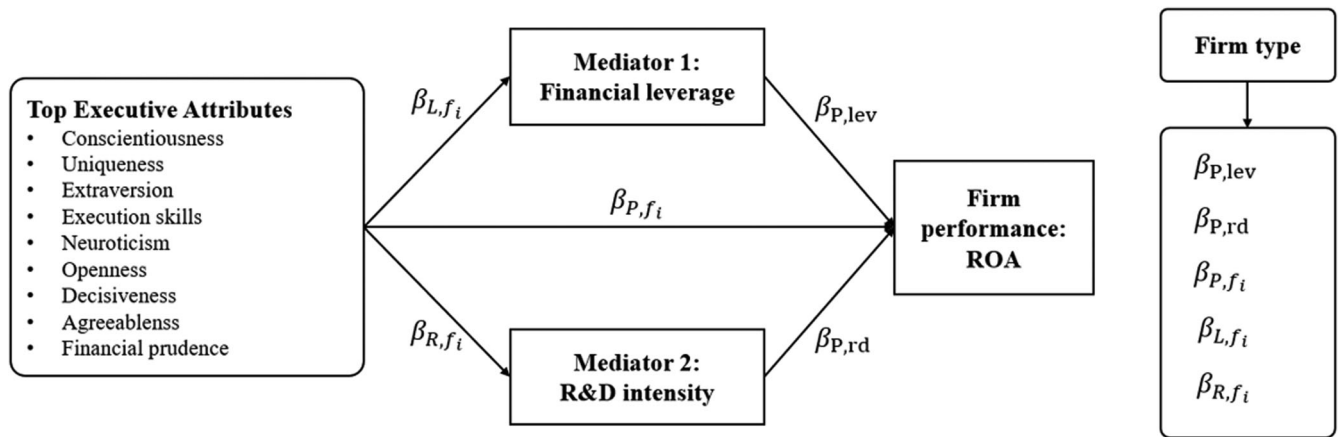


Fig. 2 Hypothesized mediation model. Two mediators include financial leverage and R&D intensity, which mediate the relationship between top executive attributes and firm performance. The estimated beta sare examined across different firm types, that is, large, medium, and small-sized firms.

Compared to small firms, the firm performance of large and medium-sized firms is less likely to be affected by the top executive’s characteristics. In medium-sized firms, there is no significant relationship between top executive’s attributes and ROA.⁸ The positive effects of *neuroticism* ($b = 0.553, p = 0.001$) and *agreeableness* ($b = 0.556, p = 0.000$) are found to be significant only in small firms. Studies on US listed-firms based on linguistic data mining also found *agreeableness* is positively related to profitability and is stronger than other personality attributes (S. Wang and Chen, 2020). However, our results indicate that in the Japanese firm context, the positive effect of *agreeableness* is more substantial in small firms. Notably, *decisiveness* has a positive effect on ROA in large firms while a negative effect on ROA in small firms.

The estimation results for financial leverage are reported in Table 6. The results for the full sample show that *neuroticism* ($b = 2.093, p = 0.000$), *openness* ($b = 1.713, p = 0.000$) and *agreeableness* ($b = 3.090, p = 0.000$) are significantly and positively related to financial leverage, while *conscientiousness* ($b = -1.567, p = 0.000$), *Decisiveness* ($b = -1.300, p = 0.000$), and *financial prudence* ($b = -4.278, p = 0.000$) have significantly negative relationships with financial leverage. Comparing the magnitude of the coefficients, *financial prudence* has the strongest negative effect on financial leverage. Ceteris paribus, a one-standard-deviation increase in the *financial prudence* score leads to 2.14% lower financial leverage, which is 4.16% lower than the average level of financial leverage in our sample, 51.39%. Comparing the magnitudes of the coefficients across different firm types, the effect of *financial prudence* on small firms is over two times stronger than that on medium-sized firms, while *financial prudence* has no significant effect on financial leverage for large firms. Compared to the estimation results for US companies using the personal leverage level of CEOs’ recent home purchases as an indicator (Cronqvist et al., 2012), the economic magnitude of the effect of the top executive’s personal financial preference in Japanese firms is also notable, especially in small firms. In contrast, *agreeableness* has the strongest positive effect on financial leverage. A one-standard-deviation increase in the *agreeableness* score leads to an increase in financial leverage of 1.79%, 3.49% higher than the mean level. The effects of *agreeableness* also vary greatly across firm types. The magnitude of the coefficient for small firms is found to be the strongest, over two times greater than that for medium-sized firms, which shows the weakest effect. For all other significant factors, except for *conscientiousness*, the magnitude of the effects on financial leverage is found to be the largest in small firms, followed by medium-sized firms and large firms.

Table 4 Goodness of fit of the model.					
	# of obs.	CFI (≥ 0.95)	TLI (≥ 0.95)	RMSEA (≤ 0.05)	SRMR (≤ 0.08)
Full sample	85,175	0.992	0.891	0.014	0.004
Large firms	5469	0.993	0.909	0.020	0.011
Medium-sized firms	48,636	0.983	0.780	0.021	0.007
Small firms	31,070	0.995	0.938	0.010	0.003

The method of parameter estimation is diagonally weighted least squares (DWLS) with robust standard errors. Model fit indices include CFI, TLI, RMSEA, and SRMR, and the goodness of fit criterion is shown in parentheses.

For the effects of top executive characteristics on R&D intensity, the results of the full sample show that *neuroticism* ($b = 0.037, p = 0.022$), *openness* ($b = 0.176, p = 0.000$), and *agreeableness* ($b = 0.040, p = 0.004$) have positive effects on R&D intensity, where *openness* has the strongest effect, as shown in Table 7. In general, a one-standard-deviation increase in the *openness* score leads to an increase in R&D intensity of 0.12%, 58.08% higher than the mean R&D intensity in our sample. This result indicates that *openness* by top executives is the key factor related to R&D activities, which is consistent with the findings of Barker and Mueller (2002) using science-related degrees or technical experience of CEOs as predictors, suggesting the important role of top executives’ technology-related attributes in R&D investment. Across firm types, the effect of *openness* is stronger in large and small firms than in medium-sized firms. This difference across firm types is the same as the effect of *agreeableness* on financial leverage. In contrast, *execution skills*, *extraversion*, and *decisiveness* are negatively related to R&D intensity. However, the magnitudes of these factors are all relatively lower than that of *openness*.

Direct, indirect and total effects on firm performance. The direct, indirect, and total effects on firm performance are calculated using Eqs. (4)–(6). The direct effects of top executive characteristics are the path coefficients β_{P,f_i} from Eq. (1). The indirect effects consist of two components, including the path through the financial leverage mediator and the path through the R&D intensity mediator, which are calculated in Eq. (5). The total effects are the sum of direct effects and indirect effects, as shown in Eq. (6).

$$\text{Direct effect}_i = \beta_{P,f_i} \tag{4}$$

Table 5 Estimation results of top executive's attributes and ROA.

	Full sample		Large firms		Medium-sized firms		Small-sized firms	
	Estimate	Std.Err	Estimate	Std.Err	Estimate	Std.Err	Estimate	Std.Err
Conscientiousness	-0.030	0.075	-0.022	0.206	-0.088	0.073	0.072	0.169
Uniqueness	0.086	0.091	-0.104	0.344	0.009	0.076	0.127	0.183
Execution Skills	-0.002	0.071	0.315	0.218	0.124	0.072*	-0.211	0.169
Extraversion	-0.116	0.065*	-0.217	0.268	-0.065	0.066	-0.141	0.140
Neuroticism	0.223	0.072***	-0.381	0.261	0.087	0.072	0.553	0.161***
Openness	0.095	0.079	-0.436	0.234*	0.016	0.076	0.341	0.198*
Decisiveness	-0.186	0.072**	0.486	0.215**	-0.099	0.069	-0.604	0.210***
Agreeableness	0.270	0.063***	-0.035	0.224	0.085	0.062	0.556	0.128***
Financial Prudence	-0.138	0.076*	-0.468	0.292	-0.080	0.075	-0.054	0.174
Financial leverage	-0.068	0.003***	-0.065	0.013***	-0.065	0.003***	-0.068	0.004***
R&D intensity	-0.247	0.040***	-0.185	0.087**	-0.242	0.044***	-0.247	0.08***
Firm size	0.253	0.041***	0.703	0.094***	0.345	0.035***	0.155	0.106
Firm age	-0.033	0.002***	-0.011	0.005**	-0.035	0.002***	-0.039	0.005***
Sales growth	0.031	0.002***	0.016	0.009*	0.025	0.003***	0.039	0.003***
Capital intensity	0.045	0.028	-0.276	0.100***	0.030	0.031	0.079	0.049
Unlisted	0.575	0.171***	0.665	0.332**	1.257	0.282***		
Medium-sized firms	-0.633	0.162***						
Small-sized firms	-0.497	0.217**						
Sector	Yes		Yes		Yes		Yes	
Year	Yes		Yes		Yes		Yes	
Location	Yes		Yes		Yes		Yes	
Obs.	85,175		5469		48,636		31,070	

The significance levels are as follows: * denotes $p < 0.1$, ** denotes $p < 0.05$, and *** denotes $p < 0.01$.

Table 6 Estimation results of top executive's attributes and financial leverage.

	Full sample		Large firms		Medium-sized firms		Small-sized firms	
	Estimate	Std.Err	Estimate	Std.Err	Estimate	Std.Err	Estimate	Std.Err
Conscientiousness	-1.567	0.391***	-2.921	1.376**	-1.551	0.402***	0.644	0.823
Uniqueness	0.328	0.508	-2.845	2.001	-0.537	0.498	2.717	0.959***
Execution Skills	-0.565	0.373	0.217	1.406	0.372	0.389	-1.506	0.830*
Extraversion	-0.045	0.325	-0.561	1.096	0.227	0.340	1.059	0.675
Neuroticism	2.093	0.375***	0.563	1.704	1.566	0.398***	4.504	0.787***
Openness	1.713	0.385***	0.230	1.331	0.477	0.418	4.473	0.856***
Decisiveness	-1.300	0.372***	-1.507	1.194	-1.207	0.392***	-0.835	0.977
Agreeableness	3.090	0.347***	3.285	1.534**	1.717	0.354***	4.596	0.682***
Financial Prudence	-4.278	0.412***	-1.139	1.581	-2.790	0.428***	-6.339	0.897***
Firm size	-6.294	0.261***	0.123	0.965	-3.016	0.199***	-13.902	0.601***
Firm age	-0.204	0.011***	-0.048	0.024**	-0.235	0.011***	-0.232	0.025***
Profitability	-1.535	0.054***	-1.071	0.313***	-1.536	0.084***	-1.484	0.069***
Tangibility	0.411	0.008***	0.284	0.029***	0.413	0.009***	0.493	0.015***
Unlisted	12.552	0.785***	18.795	0.957***	20.667	1.249***		
Medium-sized firms	-22.071	0.985***						
Small-sized firms	-22.791	1.289***						
Sector	Yes		Yes		Yes		Yes	
Year	Yes		Yes		Yes		Yes	
Location	Yes		Yes		Yes		Yes	
Obs.	85,175		5469		48,636		31,070	

The significance levels are as follows: * denotes $p < 0.1$, ** denotes $p < 0.05$, and *** denotes $p < 0.01$.

$$\text{Indirect effect}_i = \beta_{L,f_i} * \beta_{P,lev} + \beta_{R,f_i} * \beta_{P,rd} \quad (5)$$

$$\text{Total effect}_i = \beta_{P,p} + \beta_{L,f_i} * \beta_{P,lev} + \beta_{R,f_i} * \beta_{P,rd} \quad (6)$$

The indirect effects and the two components are shown in Fig. 3. The error bar shows the 95% confidence interval of effects. The effects that are significantly different from zero are highlighted. Except for *extraversion* and *execution skills*, all the other top executive characteristics are found to have

significant indirect effects on firm performance for large, medium, and small firms (see details in Supplementary Information Table S4⁹). Specifically, *conscientiousness*, *decisiveness*, and *financial prudence* have positive indirect effects on firm performance by reducing the level of financial leverage. In contrast, *uniqueness*, *neuroticism*, *openness*, and *agreeableness* have negative indirect effects on firm performance through an increase in financial leverage. Overall, the indirect effect effects through financial leverage are stronger than those through R&D

Table 7 Estimation results of top executive's attributes and R&D intensity.

	Full sample		Large firms		Medium-sized firms		Small-sized firms	
	Estimate	Std.Err	Estimate	Std.Err	Estimate	Std.Err	Estimate	Std.Err
Conscientiousness	0.019	0.016	0.063	0.117	0.037	0.019*	-0.008	0.027
Uniqueness	-0.001	0.015	0.138	0.194	0.013	0.017	-0.038	0.025
Execution Skills	-0.059	0.020***	-0.075	0.103	-0.068	0.023***	-0.039	0.038
Extraversion	-0.054	0.015***	0.002	0.079	-0.037	0.019**	-0.094	0.026***
Neuroticism	0.037	0.016**	0.074	0.104	0.027	0.018	0.058	0.031*
Openness	0.176	0.024***	0.276	0.110**	0.117	0.024***	0.280	0.057***
Decisiveness	-0.049	0.018***	-0.093	0.083	-0.016	0.018	-0.091	0.043**
Agreeableness	0.040	0.014***	0.110	0.088	0.024	0.012*	0.055	0.028**
Financial Prudence	-0.001	0.017	0.042	0.101	-0.023	0.017	0.036	0.037
Firm size	0.016	0.008**	0.068	0.04*	-0.009	0.008	0.001	0.012
Firm age	-0.003	0.001***	-0.005	0.002**	-0.004	0.001***	-0.001	0.001
Profitability	-0.007	0.002***	-0.007	0.011	-0.015	0.003***	-0.002	0.002
Capital intensity	-0.017	0.004***	-0.046	0.018**	-0.007	0.006	-0.015	0.007**
R&D missing	-1.267	0.041***	-2.140	0.142***	-0.959	0.04***	-1.685	0.105***
Unlisted	-1.230	0.106***	-0.508	0.064***	-1.785	0.244***		
Medium-sized firms	0.213	0.059***						
Small-sized firms	0.383	0.069***						
Sector	Yes		Yes		Yes		Yes	
Year	Yes		Yes		Yes		Yes	
Location	Yes		Yes		Yes		Yes	
Obs.	85,175		5469		48,636		31,070	

The significance levels are as follows: * denotes $p < 0.1$, ** denotes $p < 0.05$, and *** denotes $p < 0.01$.

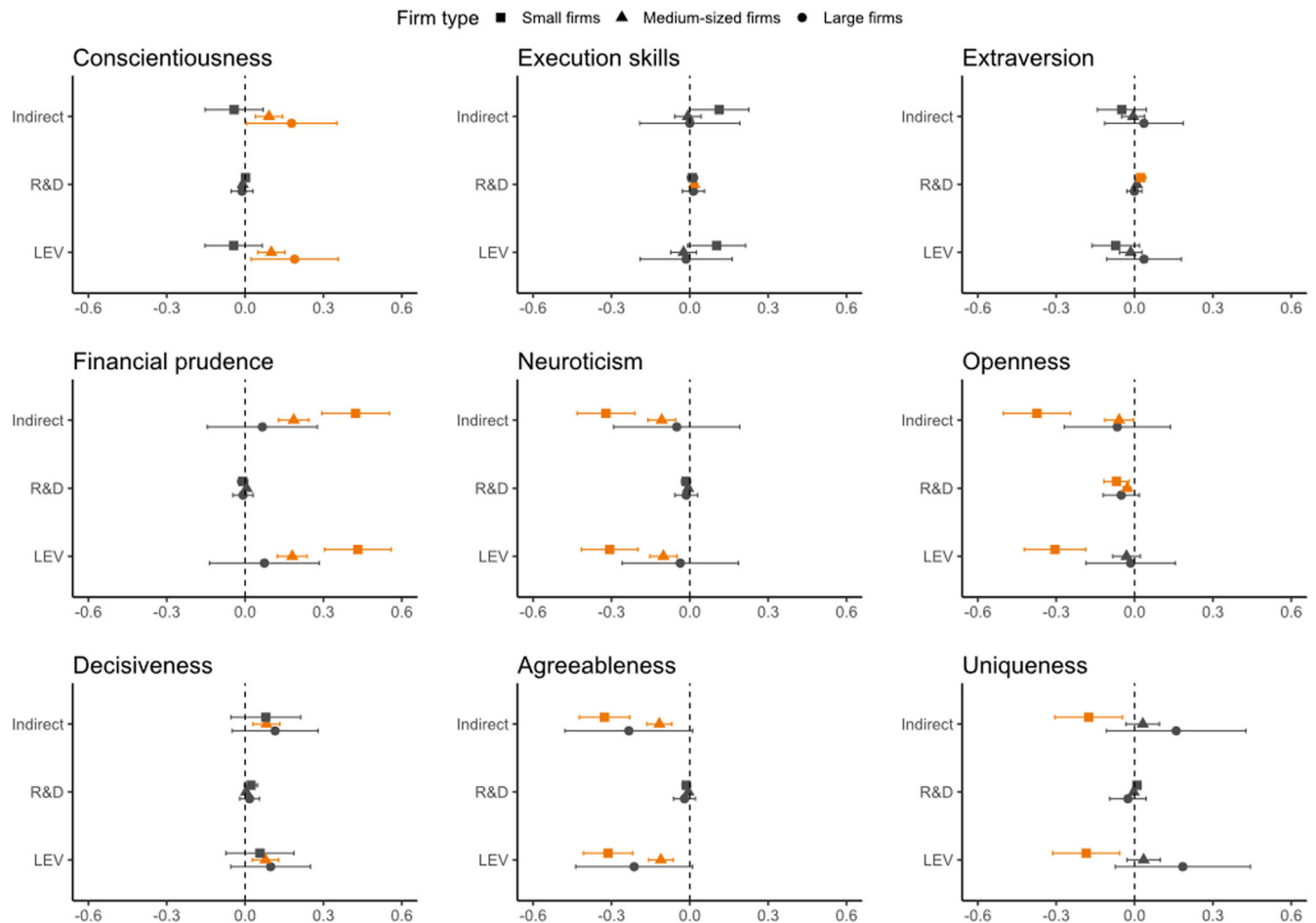


Fig. 3 Indirect effects on firm performance and the components through two mediators. The standard error bar shows the confidence interval at the 95% level. Lines in orange highlight the effects that are significantly different from zero.

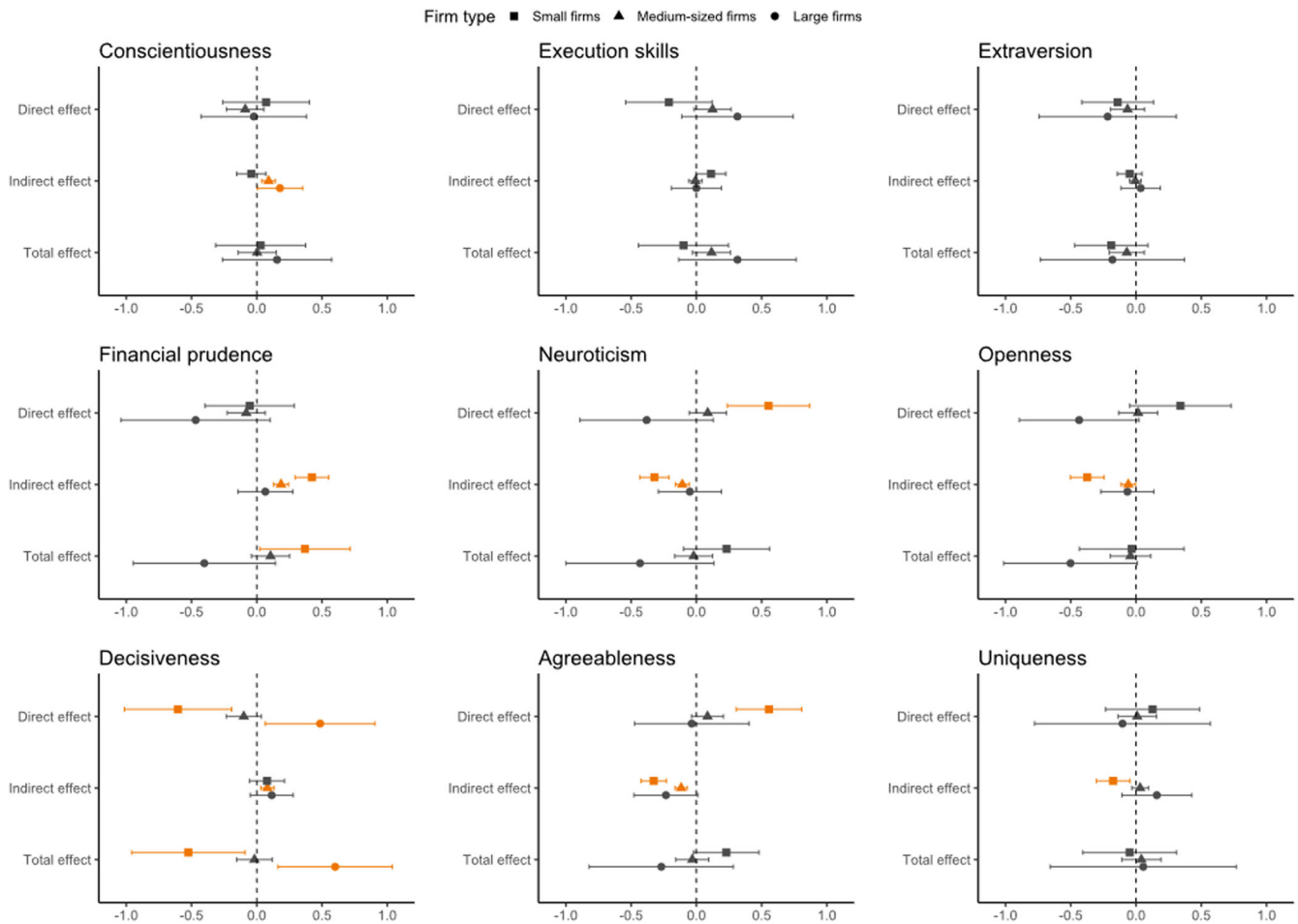


Fig. 4 Direct, indirect, and total effects on firm performance. The standard error bar shows the confidence interval at the 95% level. Lines in orange highlight the effects that are significantly different from zero.

intensity. The strongest indirect effect through R&D intensity comes from the effect of *openness*.

We may also compare the difference in indirect effects across large firms and SMEs. In terms of large firms, only *conscientiousness* is found to have a significant and positive indirect effect on firm performance, which is stronger than that of medium-sized firms. The indirect effect of *uniqueness* is found only for small firms, and the coefficient is negative for financial leverage. *Decisiveness* is found to have a positive indirect effect by reducing financial leverage, but only for medium-sized firms. For *neuroticism*, *openness*, *agreeableness*, and *financial prudence*, all the indirect effects, whether positive or negative, are stronger for small firms than for medium-sized firms. Taking the effects in small firms as an example, a one-standard-deviation increase in the *financial prudence* score leads to a rise in ROA of about 0.212 percentage points, which is 13.6% higher than the average level of ROA in our sample. On the contrary, a one-standard-deviation increase in *openness* decreased ROA by about 0.246 percentage points, which is 15.9% lower than the average ROA.

Figure 4 summarizes the direct, indirect, and total effects of top executive characteristics on firm performance by firm type. As mentioned in the section “Estimation results”, small firms are more likely to be directly influenced by top executive characteristics than medium-sized or large firms. *Neuroticism* and *agreeableness* are significantly and positively associated with better performance by small firms, while *decisiveness* has a negative direct effect on firm performance. In contrast, for large firms, the *decisiveness* of top executives may play an important

role in improving firm performance. For medium-sized firms, only *execution skills* have a significant and positive effect.

As discussed above, most top executive characteristics have indirect effects on firm performance rather than direct effects, especially in SMEs. The indirect effects are found to be stronger for small firms than for other firms. However, most total effects are found to be attenuated or even become nonsignificant because of inconsistent mediation, where indirect effects and direct effects go in opposite directions (MacKinnon et al., 2007). Taking small firms as an example, *neuroticism* and *agreeableness* have significant and positive direct effects on firm performance but also have significant and negative indirect effects. As a result, the coefficients of the two factors’ total effects are low and remain nonsignificant.

Path coefficients invariance test. A multigroup analysis is applied to test whether the path coefficients vary across subgroups, i.e., different firm types, including large, medium-sized, and small firms (Finch and French, 2015; Rosseel, 2012). We conducted a chi-square difference test to confirm the moderating effects of firm type on the mediation model. We first established the baseline model in which all the path coefficients are invariant across firm types. Then, we compared this baseline model with an unrestricted model in which all the path coefficients vary across firm types. As shown in Table 8, the significant chi-square difference between these two models implies that the path coefficients are different across firm types. Then, to identify the source of path inequality,

Table 8 Testing for path coefficient invariance across firm types.

Structural model	χ^2	df	$\Delta\chi^2$	Δdf	Pr (>Chisq)
Baseline model (all path coefficients equal across groups)	488	82			
Unrestricted model (all path coefficients vary across groups)	238.58	24	117.83	58	0.00
<i>Path coefficients: Mediator to ROA</i>					
Financial leverage	483	80	2.51	2	0.29
R&D intensity	488	80	1.28	2	0.53
<i>Path coefficients: Factors to ROA</i>					
Conscientiousness	475	80	3.55	2	0.17
Uniqueness	485	80	2.05	2	0.36
Execution skills	461	80	5.93	2	0.05
Extraversion	475	80	3.78	2	0.15
Neuroticism	471	80	3.9	2	0.14
Openness	459	80	6.43	2	0.04
Decisiveness	464	80	6.65	2	0.04
Agreeableness	487	80	1.63	2	0.44
Financial prudence	482	80	2.93	2	0.23
<i>Path coefficients: Factors to financial leverage</i>					
Conscientiousness	397.27	80	14.71	2	0.00
Uniqueness	481.77	80	2.96	2	0.23
Execution skills	358.15	80	18.56	2	0.00
Extraversion	360.93	80	19.43	2	0.00
Neuroticism	366.5	80	16.18	2	0.00
Openness	365.26	80	18.42	2	0.00
Decisiveness	404.11	80	15.28	2	0.00
Agreeableness	474.96	80	4.94	2	0.08
Financial prudence	422.61	80	15.47	2	0.00
<i>Path coefficients: Factors to R&D intensity</i>					
Conscientiousness	465.89	80	5.85	2	0.05
Uniqueness	485.88	80	2.09	2	0.35
Execution skills	452.59	80	6.48	2	0.04
Extraversion	470.3	80	4.09	2	0.13
Neuroticism	456.07	80	6.57	2	0.04
Openness	448.59	80	6.42	2	0.04
Decisiveness	460.51	80	4.93	2	0.08
Agreeableness	483.29	80	2.55	2	0.28
Financial prudence	479.26	80	2.96	2	0.23

the baseline model was compared to a set of less restrictive models in which one path coefficient was set to be unconstrained.

The results are summarized in Table 8. First, the path coefficients from both mediators to ROA have nonsignificant results, indicating that there is no significant change in the effects of firm strategy on firm performance across different firm types. Thus, the difference in the top executive's effects on firm performance across firm types is not caused by the effects of firm strategy on firm performance. Next, we examine the path coefficients from top executive characteristics to ROA; *execution skills*, *openness*, and *decisiveness* show significant differences across firm types, which verifies the change in direct effects on firm performance, especially the opposing effects of *decisiveness* for large firms and small firms. In terms of the path coefficients from the top executive characteristics to financial leverage, except for *uniqueness*, all the other characteristics have significant differences across firm types. Given the nonsignificant difference in the path coefficient from financial leverage to ROA, we can conclude that the differences in indirect effects through financial leverage are more likely to be caused by the different effects of top executive characteristics on strategic choice. The path coefficients from top executive characteristics to R&D intensity are found to be significantly different for *conscientiousness*, *execution skills*,

neuroticism, *openness*, and *decisiveness*. Likewise, these results indicate that the source of the different indirect effects through R&D intensity is the varied effects of top executive characteristics on strategic choices of R&D activities, especially the most influential factor, *openness*.

Discussion

The results of the multigroup analysis provide evidence of the different effects of top executive characteristics across large firms and SMEs, supporting the hypothesis that top executives in smaller organizations possess higher managerial discretion than those in larger organizations. First, the performance of large firms is less likely to be influenced by the top executives' attributes than that of smaller firms. We find only two positive effects on firm performance: the direct effect of *decisiveness* and the indirect effect of *conscientiousness*. Second, the effects on performance for medium-sized firms are mediated mostly by firm strategies, including characteristics linked to conservative strategic choices, such as *conscientiousness*, *decisiveness*, and *financial prudence*, and those linked to risky strategic choices, including *neuroticism*, *openness*, and *agreeableness*. Third, top executives in small firms are found to have both direct and indirect effects on firm performance. In addition to the indirect effects of *uniqueness*, *neuroticism*, *openness*, *agreeableness*, and *financial prudence*, we find that the firm performance of small firms is also directly associated with *neuroticism* and *agreeableness*. Furthermore, the indirect effects, whether positive or negative, are mostly stronger for small firms than for medium-sized firms. The inauguration types of top executives shown in Fig. 5 provide an additional explanation to support this result. In large firms, 50% of top executives are internally promoted, 12% are inaugurated through shukko (a transfer to branch offices of the same or associated company), and only 9% are externally recruited, which could leave the top executive with less power over strategy implementation and firm outcomes. In contrast, top executives of 69% of medium-sized firms and 82% of small firms are founders or family successors, which supports the argument that top executives in SMEs, as both owners and managers, possess more power over strategic choices than those in large firms (Finkelstein and Hambrick, 1996).

However, the total effects of most top executive characteristics on firm performance are found to be nonsignificant. These results are consistent with the findings of top executives' low-performance effects in Japanese firms in previous studies (Crossland and Hambrick, 2007, 2011). Our results suggest that these low-performance effects may result from inconsistent mediating effects through strategic choices, i.e., the opposing directions of direct and indirect effects. Given the notable indirect effects on SMEs, the impacts of top executives in Japanese firms are not to be neglected, especially in small firms. The path coefficient invariance test also suggests that the source of distinct mediation effects is the effect of top executive characteristics on strategic choices rather than the effect of firm strategies on firm performance.

In contrast to our hypothesis, some top executive characteristics are found to have stronger effects for large firms than for medium-sized firms, such as the indirect effects of *conscientiousness* and *agreeableness*. In addition, top executives in medium-sized firms are found to have fewer direct effects on firm performance than those in large and small firms. A possible reason for this result could be the Japanese *keiretsu* system that primarily benefits the most central firms from the view of power dependence (Brouthers et al., 2014; Kim et al., 2004), implying that top executives in large firms (central *keiretsu* firms) may have more flexibilities in strategic choices than noncentral or non-member medium-sized firms. Although no direct evidence in this

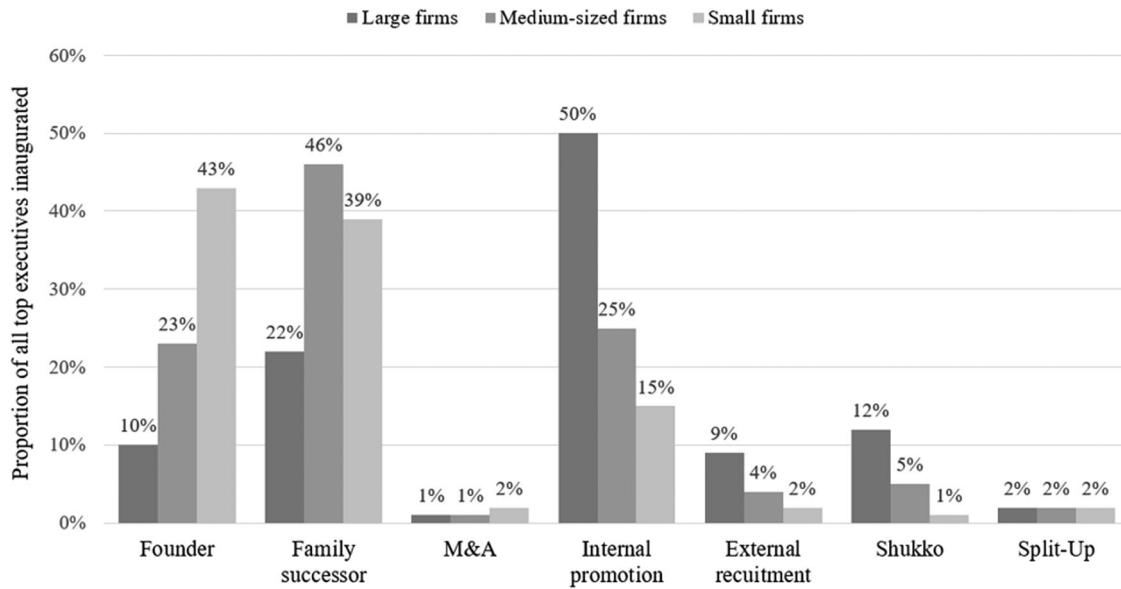


Fig. 5 Top executives' inauguration types across large firms and SMEs. The figure shows the proportion of top executives promoted through each inauguration type across large firms and SMEs. Here, "Shukko" indicates that the top executive is inaugurated through a transfer to a branch office in the same or an associated firm.

study supports this explanation, these findings encourage future studies to explore the different effects of top executive attributes on firm performance across industrial networks or business groups.

Conclusion

This study explored top executives' personalities and management skills in the context of Japanese firms and examined the nexus of these attributes, firm strategies, and outcomes across large firms and SMEs. Based on a sizeable dataset of top executives in Japanese firms, we summarized 9 factors, including the Big Five Personalities, and four essential attributes, including *uniqueness*, *execution skills*, *decisiveness*, and *financial prudence*. We built a mediation model to test the performance effect of top executive characteristics through strategic risk-related actions indicated by financial leverage and R&D intensity. By comparing the differences between large firms and SMEs, we further examined the heterogeneity of firm size in these associations.

The estimation results suggest that the top executive's attributes shape the strategic actions and outcomes of the firm. Overall, the results for the full sample imply that top executives with high *conscientiousness*, *decisiveness*, and *financial prudence* tend to choose a conservative financial policy, while top executives with high *neuroticism*, *openness*, and *agreeableness* tend to take more risks in financial policy. For R&D activities, top executives with high *openness* may strongly promote R&D investment. The performance effects of most top executive characteristics are found to be mediated by financial leverage and R&D intensity, and the indirect effects through financial leverage are stronger than those through R&D intensity.

The findings of this study may have several managerial implications for business practitioners. First, top executives in SMEs imprint their individual preferences into the firm's strategic choices. A medium-sized firm with a top executive with high *neuroticism*, *agreeableness*, and *openness* may be more likely to conduct adventurous strategies. In contrast, a top executive with high *financial prudence*, *conscientiousness*, and *decisiveness* may be more likely to execute conservative strategies. In small firms, the impacts of the top executive's attributes on strategic choices

will be much stronger than those in larger firms. It is worth noting that top executives in small firms with high *openness* strongly impact both financial leverage and R&D intensity. Even though the top executive's attributes cannot be directly linked to the firm's short-term performance, these attributes have significant indirect effects on financial outcomes through strategic choices.

However, this study still has some limitations, which encourage future research. First, the inclusion of only Japanese firms in the sample limits the generalization of the findings of the top executive's effects. Although several findings regarding financial prudence and openness are consistent with prior studies, it is still worth expanding future studies to cross-national comparisons and verifying the heterogeneity effects between large and SMEs in other cultural contexts. Second, one-dimensional contextual factors can only partially explain the variation in managerial discretion. As discussed earlier, some attributes of top executives, such as *decisiveness*, have opposing direct effects on firm performance in large and small firms. Facing the complex task environment (Blettner et al., 2012), using context typologies (Miller, 1981) that consider multidimensional factors may provide a more precise examination of the determinants of managerial discretion. Third, due to data availability with the only cross-sectional dataset, long-term performance is not investigated in this study, and it is difficult to build a causal inference model without longitudinal data on top executives. Firms in Japan, as well as those in other Asian countries and regions, value a long-term orientation (Geert et al., 2010). The main corporate objectives of Japanese firms are the pursuit of long-term performance and stakeholder benefits to secure the long-term survival and growth of the firm (Pudelko, 2009). Future studies can conduct longitudinal data collection and incorporate long-term strategy and performance to examine the effect of top executives.

Data availability

The dataset used in this study is available from the corresponding author at a reasonable request. The data are not publicly available due to privacy or ethical restrictions.

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Notes

- 1 This sample contains non-repeated observations.
- 2 Descriptive statistics for the 25 attributes of top executives are shown in Supplementary Information Table S1. Each item was rated 1 or 0 by the researchers following the interview with top executives. As shown in Table A1, 52% of the top executives in our sample are depicted as serious, 31% are steady, and 23% present execution skills.
- 3 We also run bi-quartimin and promax rotations (see Supplementary Information Table S2). The results are largely unchanged, while the results of the oblimin rotation were the most interpretable ones with the fewest overlapping factor loadings. Indices of goodness of fit (RMSEA index = 0.009; TLI = 0.963) show that the model fit the data well.
- 4 A large number of samples are dropped due to missing survey date of the top executive attributes.
- 5 As for the distribution in sectors, companies in the construction sector make up 34.71% of the sample, followed by wholesale and retail trade (26.78%), manufacturing (19.00%), services (12.89%), transportation and communication services (3.70%), real estate (2.77%), and electricity, gas, heat supply and water (0.13%). Details are shown in Supplementary Information Table S3.
- 6 We also applied maximum likelihood (ML) estimation approach. The results of DWLS estimation indicate better model fit than those of the ML estimation. The models are estimated using R package “lavaan” (Rosseel, 2012).
- 7 Here, the chi-square goodness of fit test was not used to assess model fit, since the test is too restrictive and almost rejected when the sample size is sufficiently large (Bollen, 1990).
- 8 Results at the significance level of $p < 0.05$ are discussed as the main findings.
- 9 The detailed results are shown in Supplementary Information Table S4. The discussion here is based on the 95% confidence interval of effects, as shown in Figs. 3 and 4.

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Competing interests

The authors declare no competing interests.

Ethical approval

The appropriate legal and ethics review board of Teikoku Databank Ltd. approved the study design. All the methods were performed in accordance with ethical guidelines, and access to unlisted firms' financial data is under the permission of Teikoku Databank Ltd.

Informed consent

The data regarding top executives' credit research was provided with informed consent from all the participants under ethical guidelines in Teikoku Databank Ltd., and personal information is non-identifiable.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-023-01628-8>.

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