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C.E.O. academic experience and firm sustainable growth

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ABSTRACT

Chief executive officers (C.E.O.s) play a dominant role in firm decision-makings and operations, and their characteristics will affect firm sustainable growth. This study investigates whether C.E.O. academic experience affects firm sustainable growth. Using a sample from China, we find that C.E.O. academic experience is positively related to firm sustainable growth, and the effect is pronounced for high-tech firms. Further analyses demonstrate that the results are robust to alternative measures and controlling for endogeneity problems. Finally, the channel analysis shows that the effect is partially driven by firm innovation and internal control.

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1. Introduction

The global economy has been in a downturn since the financial crisis in 2008. Firm sustainable growth becomes an important topic for scholars and practitioners. For example, Evergrande Group which had been the largest commercial group in China, face server sustainable growth crisis (The Xinhua News Agency, 2021). Given the vital importance of firm sustainable growth, an increasing topic in accounting and management literature involves understanding why different corporations achieve sustainable growth differently, that is what drives firm sustainable growth. Early scholarly work observed firm sustainable growth are not only driven by firm hard resources, but also soft resources, such as intellectual capital (Anwar et al., 2018), innovation (Ge et al., 2018), financial capabilities (Berge et al., 2015), board gender diversity (Ain et al., 2021). However, previous literature often evades or ignores the impact of chief executive officer (C.E.O.) on firm sustainable growth, although a few scholars focus on employees (Antoncic & Antoncic, 2011). C.E.O.s are the most important decision-makers for a firm's long-term development, while employees are just practitioners of decisions. As a public firm's most powerful figure and in a position to shape and influence, C.E.O.s significantly impact firms (Graham et al., 2015; Hambrick &

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Mason, 1984). Therefore, this study aims to fill the void by investigating C.E.O. and firm sustainable growth.

Personal characteristics of decision-makers significantly impact decision behaviors (Hambrick & Mason, 1984). Previous research finds the heterogeneity in C.E.O.s' managerial style reflects the variation in their life experience, for example, military experience (Benmelech & Frydman, 2015), overseas experience (Le & Kroll, 2017), and poverty experience (Xu & Li, 2016; Xu & Ma, 2022). In this study, we focus on a special experience, the academic experience. Previous research on C.E.O. life experience are mainly based on imprinting theory (Marquis & Tilcsik, 2013) that sense experience can shape stamp on a focal entity and make lasting effect on the focal entity. However, research on the impact of experiences like military experience, the Great Depression experience, and overseas experience on decision making might make some noise. These experiences shape imprinting stamps through the focal entity's perception of the external environment. Whereas, the perception of different individuals might shape different stamps on focal entities. For example, Benmelech and Frydman (2015) find Military C.E.O.s are associated with conservative corporate policies. But Lai et al. (2016) find military managers adopt radical financial policies. C.E.O.s with fatal disasters do not become more aggressive, whereas C.E.O.s who witness the extreme downside of disasters behave more conservatively (Benmelech & Frydman, 2015).

It is difficult to find how the external experience transfer to intrinsic impact on decision making. However, the academic experience can provide clearer explanations. Academic experience is a rigorous systemic training of logical thinking (Jiang & Murphy, 2007; Shen et al., 2020; Zhang et al., 2021). It shapes decisions makers' thoughts and behaviour norms directly. The impact of academic experience on C.E.O.s' decision-making does not need to transfer from the perception of the external environment to the stamp of decision-makers. Notwithstanding the fruitful findings regarding the relationship between firm performance and C.E.O.s' demographic, psychological characteristics, and other factors, the role of the C.E.O.'s academic experience (academic C.E.O.) in firms' sustainable growth remains understudied.

We find a general tendency that scholars are encouraged to start up their businesses. For example, the Ministry of Human Resources and Social Security of China issued guiding opinions on encouraging professional technical personnel of public institutions in innovation and entrepreneurship in March 2017 (Guiding Opinions on Encouraging Professional Technical Personnel of Public institutions in Innovation and Entrepreneurship). The European Union began encouraging researchers to start businesses as early as 2003 (Commission Communication, 2003). Australian Government emphasized the increasing collaboration between industry and researchers at 2015 (National Innovation and Science Agenda Report, 2015). However, whether firms can benefit from this policy is unknown. Therefore, we answer this question using a sample from Chinese-listed companies with data spanning from 2010 to 2017. The reasons why we select China as our setting are the following. In China, after the reforming and opening-up policy, many scholars start up their businesses, which provides a sufficient sample for our research. In addition, a special Confucian culture in China that individuals with excellent performance in the study

are encouraged to participate in politics no in business. Compared to Western countries, China provides a suitable setting because China is far less mercantilist than western countries. Furthermore, worldwide firms face sustainability pressure since the financial crisis in 2008. China is the world's second largest economy and the largest developing country. We can provide implications for the world's emerging economy. Therefore, China is a suitable setting for our research.

We find that C.E.O. academic experience is positively related to firm sustainable growth. And we explore whether and how this positive relation varies with industry characteristics. We find the effect on C.E.O. academic experience and firm sustainability is pronounced in high-tech firms. We further explore plausible channels. We show that firm innovation input and internal control are potential channels in the effect of C.E.O. with academic experience on firm sustainability.

To ensure the robustness of our results, we repeat our main test using the Van Horn model in addition to the sustainable growth rate (S.G.R.) model, and we still find a significantly positive relation between C.E.O. academic experience and firm sustainability. A Heckman-type correction is also performed using a two-stage Heckman model to mitigate any potential sample selection bias. And we further use the propensity score matching (P.S.M.) method to alleviate this problem.

This study makes contributions in several ways. This study extends the strand of research on the determinants of firm sustainable growth. This study highlights the role of C.E.O. academic experience in enhancing firm sustainable growth. It is a worldwide tendency that researchers are encouraged to start up their own business, which can improve firm innovation and entrepreneurship research. While previous research explored the personal-, firm- and market-level characteristics, for example, gender age, educational background, major shareholder control, capital market transparency that can affect firms' sustainable growth (Ani et al., 2021; Jiang & Zhang, 2012; Rajan & Zingales, 1998; Yang et al., 2018). Few types of research focus on C.E.O.s' academic experience and how it affects sustainable growth. We provide an empirical exploration of this issue.

Second, we also expand research on the highly echelons theory by responding to the calls to open the 'black box' between executives' characteristics and organisational results. Although existing research has investigated the impact of various C.E.O. life experience, opposite results of the same experience can be found due to the difficulty in identifying how the C.E.O.'s perception of the external environment transfer into the intrinsic impact of decision making. By exploring C.E.O.s' academic experience, we do not only extend research on high echelon theory but also provide a more direct setting to analyse C.E.O. experience and organisational results.

Third, this study acknowledges the importance of innovation by examining the mediating effect of innovation on the association between C.E.O. academic experience and firm sustainable growth. We find R&D investment plays mediating effect on the association between C.E.O. academic experience and corporate sustainable growth. C.E.O.s with academic experience can pay more attention to innovation and promote corporate competitive advantages, which provides references to corporate innovation and development.

Forth, this study also acknowledges the importance of internal control by examining the mediating effect of internal control quality on the association between C.E.O. academic experience and firm sustainable growth. We find internal control quality plays mediating effect on the association between C.E.O. academic experience and corporate sustainable growth. C.E.O.s with academic experience can improve firm internal control quality, which provides references to corporate governance and long-term development.

Last, this study makes policy implications to the government. It is a general tendency that researchers are encouraged to start up their own business, which can improve firm innovation and entrepreneurship research, for example in China, European Union, and Australia. Our study provides empirical evidence for the rationale of this policy. And we also make implications for emerging economies like China. After the financial crisis in 2008, firm sustainable growth becomes a vital topic for practitioners. We provide empirical evidence that firms can employ academic C.E.O.s to improve sustainable growth, especially for high-tech firms.

The article is organised as follows. Section 2 presents a literature review on C.E.O.'s academic experience and sustainable growth and develops the research hypotheses. Section 3 describes our methodology. Section 4 discusses the empirical results. Section 5 concludes and provides implications.

2. Literature review and hypothesis development

Sustainability is increasingly accepted as an important driver of firm long-term performance. Prior research explores macro-level factors like capital market and firm-level factors such as corporate social responsibility, intellectual capital and corporate governance, and debt heterogeneity on firm sustainability (Ahsan et al., 2021; Rajan & Zingales, 1998; Xu & Wang, 2018). Based on upper echelon theory, rich studies investigate personal characteristics of senior executives such as gender, age, education level, tenure, professional background, and their economic consequences (Ain et al., 2020; Ali & Zhang, 2015; Banbhan et al., 2018; Custódio & Metzger, 2014; Jiang & Zhang, 2012; Kish-Gephart & Campbell, 2015). Recently, academic experience receives increasing attention from academic researchers. A few studies find the academic experience of senior executives can improve internal control quality (Zhang et al., 2020) and corporate green innovation (He et al., 2021). However, few studies investigate the academic experience of C.E.O.s and its economic consequences. Academic experience, a special work experience, will inevitably have a profound impact on the C.E.O., leaders of top management teams, personal cognition, logical thinking, and values, thus affecting their decision making and corporate sustainable growth.

Theoretically, C.E.O.s with academic experience have both positive and negative effects on corporate sustainable growth. Firstly, academic experience shapes a C.E.O.'s logical thinking and behaviours (Jiang & Murphy, 2007; Shen et al., 2020). Systematic and rigorous academic training help C.E.O.s make decisions based more on data and facts (Cho et al., 2017). C.E.O. with academic experience can contribute to formulating reasonable and scientific internal control rules and improving corporate

governance, especially in highly uncertain environment (Jiang & Murphy, 2007). Furthermore, the logical thinking of C.E.O.s can optimise the organisational structure, ownership structure, and shareholding structure, leading to a higher quality of corporate governance (Shen et al., 2020). Higher quality of corporate governance is positively related to firm sustainable growth (Mukherjee & Sen, 2019).

Secondly, academic C.E.O.s tend to be more conservative due to rigorous academic training and the protection of their reputation (Quan & Li, 2017; Pang et al., 2020). Due to long-term academic training, Academic C.E.O.s have developed habits of rigor and scrutiny. Academic C.E.O.s tend to be risk-averse and have better risk management abilities (Bamber et al., 2010; Bertrand & Schoar, 2003; Jiang & Murphy, 2007; Malmendier et al., 2011). Better risk management is beneficial for firm sustainable growth. Academic C.E.O.s also cultivate high ethical standards and receive social respect during their academic career. They have stronger incentives to make long-term decisions (Shen et al., 2020; Zhou et al., 2017). And they are positively correlated to reducing short-termism behaviours, including personal on-the-job consumption, taxation avoidance, and ineffective investments, and improving long-term behaviors (Zhang et al., 2020; Jiang & Murphy, 2007; Lou, 2019; Zhang et al., 2020). Moreover, academic C.E.O.s always own highly social status. They are more likely to have higher requirements to protect their reputations (Francis et al., 2015; Quan & Li, 2017). They make higher requirements for the quality of company information disclosures, reducing the degree of information asymmetry (Banerjee, 2013; Belkhir et al., 2014; Francis et al., 2015), to ease financing constraints and improve long-term sustainable growth (Redfern, 2004; Sufi, 2007).

However, C.E.O.s with academic experience possess stronger personal abilities, which makes their immoral acts more difficult to be found. For example, that C.E.O.s with academic experience have stronger real earnings management motivation (Xu & Guo, 2020). And C.E.O.s with academic experience may use their reputation to pursue attractive short-term benefits, which damages firms' sustainable growth (Pang et al., 2020). And C.E.O. with academic experience might lack practical experience, which may lead to wrong decisions and reduce effectiveness.

These discussions suggest that the effect of C.E.O. academic experience on firm sustainable growth is an empirical question. We predict that the positive role is dominated and formally state the first hypothesis as follows

> H1: C.E.O. academic experience has a significantly positive effect on the firm sustainable growth.

The intellectual capital of top management teams is heterogeneous in different industries, and the positive effect is more obvious in high-tech industries. Knowledge-intensive and technology-intensive are distinguishing features in high-tech industries. Li (2011) found that human capital significantly promotes energy efficiency in firms with high innovation intensity in high-tech industries. Peng and Mao (2017) found that in the high-tech industry, top management members with R&D backgrounds will significantly promote corporate R&D investment.

Academic C.E.O.s can create great value by signifying the value of correspondence between academic expertise and functional business area (Jiang & Murphy, 2007). Academic C.E.O.s will affect the innovation preferences of whole firms (Shen et al.,

2020). Their professional knowledge and experience will transform into firms' advantageous resources, thereby promoting sustainable corporate growth. Scholars master cutting-edge knowledge and technology in their field, which can make a breakthrough in technological innovation and product development. This effect will be more significant in the high-tech industry. Therefore, we propose hypotheses:

H2: In the high-tech industry, the association between C.E.O.'s academic experience and sustainable growth is pronounced.

3. Methodology

3.1. Sample selection

We use a sample of publicly listed A-share Chinese firms from 2010 to 2017. We start our sample from 2010 to isolate the influence of global financial crisis during 2007–2009. And we end our sample in 2017 to isolate the influence of the policy issued by Ministry of Human Resources and Social Security of China titled 'Supporting and Encouraging Professional Technical Personnel of Public Institutions in Innovation and Entrepreneurship' in 2017.

We obtain C.E.O. academic experience data and other variables from C.S.M.A.R. databases. Missing values of C.E.O. experience are manually supplemented by referring to C.E.O.'s resume and other ways.

We exclude financial companies and S.T. firms and delete firms with missing data. Our final sample includes 16,127 firm-year observations. To rule out the influence of outliers, we exclude the tail treatment of continuous variables at 1% and 99% levels.

3.2. Model

To test H1 and H2, we estimate the following model:

$$SGR_{i,t} = \beta_0 + \beta_1 Academic_{i,t} + \beta_2 ControlVariables + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (1)$$

In equation (1), the dependent variable *SGR* measures firm sustainable growth capabilities. Academic measures firm's academic experience. *ControlVariables* are control variables. The model includes year and industry fixed-effects.

3.3. Variable definition

3.3.1. Measurement of sustainable growth

S.G.R. is achieved by companies using their own funds without external financing from banks or financial markets (Higgins, 1977). The sustainable growth rate is computed referring to Higgins (1977):

$$\mathrm{SGR} = \frac{p(1-d)(1+L)}{t - p(1-d)(1+L)} \quad (2)$$

Table 1. Variable definition.

Variable	Definition
SGR	Sustainable growth estimated by Higgins (1977)
Academic	Dummy variable, Academic = 1 if CEO with academic experience, otherwise Academic =0
NonCEOAcademic	Dummy variable, NonCEOAcademic = 1 if non-CEO senior executive with academic experience, otherwise NonCEOAcademic =0
CorAge	Firm age
Size	Logarithm of the company's total assets
Lev	Total liabilities/Total assets;
ROA	Profit before interest and taxes/Average total assets
Indep	Number of independent directors/Number of board of directors
Duality	Dummy variable, if the same person serves as chairman and CEO, the value is 1, otherwise is 0
Top1	The percentage of shares held by the largest shareholder
SOE	Dummy variable, state-owned enterprises is 1, non-state-owned enterprises is 0
Age	The age of CEO
Edu	If the CEO has a master's degree or above, the value is 1, otherwise the value is 0
Gender	Dummy variable, male is 1 and female is 0
Pay	The logarithm of (CEO salary +1)
Financial	Dummy variable, Military = 1 if CEO with financial experience, otherwise Military =0
Overseas	Dummy variable, Overseas = 1 if CEO with overseas experience, otherwise Overseas =0
Military	Dummy variable, Military = 1 if CEO with military experience, otherwise Military =0

Source: CSMAR database and open data.

where p is the net profit margin on sales, d is the dividend payout ratio, L is the debt to equity ratio, and t is measured by total assets to sales.

3.3.2. C.E.O. academic experience

We define C.E.O. academic experience as that C.E.O. served or is served in colleges, research institutions, or research association. Otherwise, there is no academic experience (Zhang et al., 2020; Zhou et al., 2017). Noteworthily, Academic experience, and educational background have significant differences in C.E.O. decision-making behaviors and the signals conveyed to the capital market (Bernile et al., 2017). Academic experience emphasis more on the influence of systemic rigorous academic training on C.E.O.s' logical thinking and ethics. The educational background emphasis more on the influence of knowledge learned on C.E.O.s' ability.

3.3.3. Control variables

We select control variables following the previous studies on the determinants of corporate sustainable growth referring to Chen et al. (2021), de Lange et al. (2012) and He et al. (2021). Table 1 lists all variables' definitions.

4. Empirical results

4.1. Descriptive statistics

Table 2 reports descriptive statistics results. Approximately 24% of our sample firms have academic C.E.O. and the percentage of non-C.E.O. senior executives with academic experience is 27.8%. The mean of firm sustainable growth is 0.052 but the maximum of firm sustainable growth is 0.391. The means of firm size (Size), leverage (*Lev*), and accounting performance (*ROA*) are 21.906, 0.409 and 0.067, respectively. The mean ownership of the largest shareholder (*TOP1*) is 34.974% and 37.2% of

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
SGR	16127	.052	.103	-.545	.391
Academic	16127	.241	.428	0	1
CorAge	16127	15.104	5.707	0	50
NonCEOAcademic	16127	.278	.448	0	1
Size	16127	21.906	1.272	19.213	25.912
Lev	16127	.409	.217	.046	.975
ROA	16127	.067	.062	-.154	.275
Indep	16127	.372	.055	.33	.57
Duality	16127	.294	.456	0	1
Top1	16127	34.974	15.044	8.63	75.52
SOE	16127	.325	.468	0	1
Age	16127	49.027	6.454	27	75
Edu	16127	.509	.5	0	1
Gender	16127	.936	.245	0	1
Pay	16127	12.941	1.829	0	16.639
Financial	16127	.093	.29	0	1
Overseas	16127	.079	.269	0	1
Military	16127	.01	.1	0	1

Notes: *SGR* is the measure of sustainable growth rate estimated using Higgins' model (Higgins, 1977). *Academic* is an indicator variable that equals one if C.E.O. has the academic experience, and zero otherwise. *NonCEOAcademic* is an indicator variable that equals one if Non-C.E.O. senior executives have academic experience, and zero otherwise. Source: CSMAR database and open data.

board directors are independent (*Indep*). About 32.5% of the sample firms are state-owned enterprises (*SOE*) and 29.4% of the sample C.E.O. are also served as chairman (*Duality*).

C.E.O. average age of our sample is about 49 years old, and approximately 50.9% of C.E.O.s have a master's degree or above (*Edu*), 93.6% are male (*Gender*). An only a small proportion of C.E.O.s with other special experience. C.E.O.s with financial experience (*Financial*) and C.E.O.s with overseas experience (*Overseas*) account for 9.3% and 7.9%, respectively. And C.E.O.s with military experience (*Military*) only account for 1%. In sum, the values of these variables are reasonably distributed with some degrees of variation and are comparable with what has been documented in prior studies (Zhang et al., 2020; Liu & Zhou, 2019; Yang et al., 2018; Zhang, 2019).

4.2. Estimates of Pearson correlation coefficients

Table 3 provides the Pearson correlation matrix. S.G.R. is positively correlated with Academic, consistent with our theoretical prediction that firms having C.E.O. with academic experience are associated with higher sustainable growth ability.

4.3. Regression results

4.3.1. Testing hypothesis 1

Columns (1) and (2) in Table 4 presents our regression analysis of firm sustainable growth focusing on C.E.O. academic experience. We find that the coefficients of *Academic* are significantly positive, suggesting that firms that have C.E.O. with academic experience are associated with higher sustainable growth ability. The results support that academic C.E.O.s can improve firm sustainable growth.

Table 3. Pearson correlation coefficients.

	SGR	Academic	CorAge	NonCEO Academic	Size	Lev	ROA	Indep	Duality	Top1	SOE	Age	Edu	Gender	Pay	Financial	Overseas	Military
SGR	1																	
Academic	0.042***	1																
CorAge	−0.038***	−0.103***	1															
NonCEOAcademic	0.038***	0.158***	−0.031***	1														
Size	0.095***	−0.069***	0.149***	0.058***	1													
Lev	−0.118***	−0.106***	0.216***	−0.050***	0.493***	1												
ROA	0.695***	0.056***	−0.110***	0.033***	−0.044***	−0.301***	1											
Indep	−0.016**	0.039***	−0.017**	0.00300	0.016**	−0.017**	−0.024***	1										
Duality	0.019**	0.246***	−0.094***	0.046***	−0.183***	−0.163***	0.072***	0.116***	1									
Top1	0.099***	−0.00700	−0.116***	−0.017**	0.186***	0.046***	0.105***	0.065***	−0.027***	1								
SOE	−0.050***	−0.139***	0.178***	−0.023***	0.377***	0.331***	−0.146***	−0.068***	−0.280***	0.165***	1							
Age	−0.00900	0.076***	0.118***	0.00800	0.121***	0.035***	−0.016**	0.00700	0.164***	0.024***	0.120***	1						
Edu	0.016**	0.122***	0.0100	0.095***	0.116***	0.057***	−0.00800	0.021***	0.00300	0.00600	0.106***	−0.079***	1					
Gender	−0.032***	0.00700	−0.013*	0.020**	0.046***	0.032***	−0.028***	−0.046***	0.039***	−0.028***	0.073***	0.039***	0.00600	1				
Pay	0.128***	0.037***	0.017**	0.063***	0.075***	−0.038***	0.136***	−0.026***	−0.00100	−0.031***	−0.043***	0.036***	0.018**	−0.00400	1			
Financial	−0.00600	−0.078***	0.087***	−0.014*	0.058***	0.072***	−0.023***	−0.00600	−0.113***	0	0.050***	−0.030***	0.024***	−0.099***	−0.014*	1		
Overseas	0.013*	0.055***	−0.025***	0.031***	−0.016**	−0.062***	0.020***	0.043***	0.043***	−0.00300	−0.088***	−0.064***	0.139***	−0.00900	0.018**	−0.020**	1	
Military	−0.014*	0.035***	0.0130	0.015*	−0.035***	0.0110	0.00200	0.0110	0.018**	−0.00900	−0.00500	0.050***	−0.018**	0.016**	−0.015*	−0.00900	0.014*	1

Source: CSMAR database and open data.

Table 4. Regression results.

Variables	(1) Full sample SGR	(2) Full sample SGR	(3) Hightech = 0 SGR	(4) Hightech = 1 SGR
Academic	0.011***	0.004***	0.003	0.003***
	(6.58)	(3.09)	(1.40)	(2.70)
CorAge		0.000***	0.001***	0.000***
		(3.43)	(3.31)	(2.70)
NonCEOAcademic		0.001	−0.003	0.002*
		(1.29)	(-1.25)	(1.78)
Size		0.008***	0.012***	0.006***
		(7.35)	(5.96)	(4.58)
Lev		0.010	−0.006	0.019*
		(1.17)	(-0.36)	(1.89)
ROA		1.165***	1.183***	1.156***
		(48.21)	(24.42)	(43.28)
Indep		−0.004	−0.003	−0.002
		(-0.40)	(-0.15)	(-0.18)
Duality		−0.001	−0.001	−0.001
		(-0.86)	(-0.43)	(-0.50)
Top1		0.000	0.000*	−0.000
		(0.82)	(1.67)	(-0.24)
SOE		0.001	−0.000	0.001
		(0.50)	(-0.03)	(0.31)
Age		−0.000	−0.000	−0.000
		(-1.01)	(-0.26)	(-1.48)
Edu		0.001	−0.004**	0.003**
		(0.48)	(-2.08)	(2.29)
Gender		−0.006**	−0.006	−0.006**
		(-2.31)	(-1.46)	(-2.15)
Pay		0.001**	0.001	0.001**
		(2.35)	(1.14)	(2.32)
Financial		−0.001	0.004	−0.004
		(-0.25)	(1.28)	(-1.24)
Overseas		0.002	0.013***	−0.002
		(1.19)	(3.56)	(-1.24)
Military		−0.012	−0.011	−0.012
		(-1.32)	(-1.03)	(-0.95)
Constant	0.045***	−0.216***	−0.282***	−0.177***
	(4.67)	(-9.23)	(-6.98)	(-6.39)
Ind FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	16,127	16,127	5,838	10,289
Adjusted R^2	0.024	0.512	0.482	0.539
F-Value	13.29	105.75	44.40	117.35

Notes: *SGR* is the measure of sustainable growth rate estimated using Higgins' model (Higgins, 1977). *Academic* is an indicator variable that equals one if CEO has academic experience, and zero otherwise. *NonCEOAcademic* is an indicator variable that equals one if Non-CEO senior executives have academic experience, and zero otherwise. The sample is partitioned into two subsamples based on whether the firm is in high-tech industry. *Hightech* equals one if the firm is in high-tech industry, and zero otherwise. All t-statistics in parentheses are computed using the standard errors adjusted by White's method in our study (White, 1980). ***, ** and * denote significance levels at 1%, 5% and 10%, respectively.
Source: CSMAR database and open data.

4.3.2. Testing hypothesis 2

We test our second hypothesis by partitioning our sample into two subsamples on the criteria of whether sample firms are in the high-tech industry according to the industry classification standard of the China Securities Regulatory Commission in 2012. We then re-estimate equation (1) separately for each subsample partitioned. Columns (3) and (4) in Table 4 reports the results. The results show that the coefficients on academics are positive in two columns but only significant in the subsample

of firms in the high-tech industry. These results suggest that the effect of academics on firm sustainable growth is more pronounced in firms in the high-tech industry.

Additionally, in the high-tech industry group, the coefficient of C.E.O. education background is significantly positive with firm sustainable growth. Compared with the results in Column (2), C.E.O. education background has a significant role in the high-tech industry, supports that firms in high-tech industries can signify the value of correspondence between intellectual capital and functional business area.

4.4. Robustness test

4.4.1. Endogeneity

There may be certain endogenous problems. On the one hand, companies with strong sustainable growth capabilities may be inclined to hire C.E.O.s with academic backgrounds for the emphasis on the intellectual capital of executives and the pursuit of innovation. There is a reverse causality problem. On the other hand, C.E.O.s with academic experience may be more inclined to work in companies with strong sustainable growth capabilities due to their own professional development considerations and unique considerations for the company, and there is a self-selection bias. We use the Heckman two-stage method, the lead-lag period test, and the P.S.M. method to alleviate potential endogeneity problems.

We use the Heckman two-stage regression to alleviate the self-selection problem. Referring to Zhou et al. (2017), we added the average industry C.E.O. with academic experience in the previous year (*IV_Aca*) ad an instrumental variable in the first stage. The academic experience ratio of C.E.O.s in the same industry reflects the importance the industry attaches to the academic experience, the academic atmosphere of the industry. Companies in higher ratio industries are more inclined to hire C.E.O. with academic experience. The proportion of academic experience of C.E.O.s in the same industry has no direct impact on the sustainable growth ability of a particular company. It is just identification as the same number of endogenous explanatory variables and instrumental variables. We conducted a weak instrumental variable test for the instrumental variables, and the results show that the Cragg-Donald Wald F value is 43.1446, which is much greater than 10, indicating that there is no weak instrumental variable problem, and the choice of instrumental variable is appropriate.

Panel A of Table 5 shows the results of Heckman two-stage test. According to column (1), the regression coefficient of the instrumental variable (*IV_Aca*) is significant at the 1% level. From column (2) to (4), the coefficients of C.E.O. academic experience (*Academic*) with full sample and subsample in high-tech industries are still significantly positive at the 5% level, indicating that our results are still valid and robust.

To alleviate the endogenous problem of reverse causality, we process the variables with a lagging period and obtain 12,691 observations. Panel B of Table 5 shows the results. Our results are robust.

We use P.S.M. to solve self-selection bias referring to Zhou et al. (2017). We use kernel matching method and use default density function and radius to match samples with academic C.E.O.s and without academic C.E.O.s and obtain matched samples. Panel C of Table 5 lists regression results of matched samples. It suggests our conclusions are robust.

Table 5. Endogeneity test.

Panel A Heckman two-stage regression

Variables	(1) Full sample Academic	(2) Full sample SGR	(3) Hightech = 1 SGR	(4) Hightech = 0 SGR
Academic		0.003**	0.004**	0.003
		(2.35)	(2.25)	(1.07)
IV_Aca	4.157***			
	(6.91)			
Imr		−0.003	−0.075***	0.015
		(-0.21)	(-3.21)	(0.86)
NonCEOAcademic	0.388***	0.000	−0.019***	0.003
	(15.32)	(0.08)	(-2.86)	(0.51)
Financial	−0.271***	0.002	0.013**	0.001
	(-5.89)	(0.47)	(2.50)	(0.18)
Overseas	0.084**	0.001	−0.008***	0.013***
	(1.99)	(0.44)	(-2.91)	(2.98)
Military	0.387***	−0.012*	−0.030***	−0.010
	(3.63)	(-1.77)	(-3.24)	(-0.87)
Other controls	Yes	Yes	Yes	Yes
Constant	−3.471***	−0.205***	−0.025	−0.293***
	(-8.97)	(-6.08)	(-0.41)	(-6.10)
Ind FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	15,896	16,127	10,289	5,838
Adjusted R^2		0.525	0.550	0.494
F-Value		173.48	272.29	70.13

Panel B: Lead-lag approach

Variables	(1) Full Sample SGRt + 1	(2) Hightech = 0 SGRt + 1	(3) Hightech = 1 SGRt + 1
Academic	0.005***	0.005	0.006***
	(3.07)	(1.37)	(2.89)
NonCEOAcademic	0.001	−0.007**	0.004*
	(0.63)	(-2.08)	(1.75)
Financial	0.004	0.007	0.002
	(1.21)	(1.53)	(0.40)
Overseas	0.007**	0.016***	0.003
	(2.47)	(2.80)	(1.00)
Military	−0.006	−0.010	−0.002
	(-0.50)	(-0.52)	(-0.11)
Other controls	Yes	Yes	Yes
Constant	−0.177***	−0.219***	−0.145***
	(-6.08)	(-4.86)	(-4.02)
Ind FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	12,691	4,597	8,094
Adjusted R^2	0.181	0.195	0.177
F-value	32.64	13.38	33.08

Panel C Matched samples results

Variables	(1) Full sample SGR	(2) Hightech = 0 SGR	(3) Hightech = 1 SGR
Academic	0.003**	0.002	0.003**
	(2.00)	(0.75)	(1.99)
NonCEOAcademic	0.002*	0.004	0.002
	(1.75)	(1.22)	(0.99)
Financial	0.001	0.000	0.001
	(0.26)	(0.06)	(0.32)
Overseas	−0.003	0.002	−0.005**
	(-1.28)	(0.44)	(-2.01)

(*continued*)

Table 5. Continued.

Panel C Matched samples results

Variables	(1) Full sample SGR	(2) Hightech = 0 SGR	(3) Hightech = 1 SGR
Military	0.001	−0.001	0.001
	(0.18)	(-0.07)	(0.10)
Other controls	Yes	Yes	Yes
Constant	−0.122***	−0.177***	−0.130***
	(-6.50)	(-5.57)	(-6.41)
Ind FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	9,876	3,291	6,585
Adjusted R^2	0.554	0.524	0.578
F-Value	122.71	45.92	199.34

Notes: *Imr* is estimated using the Probit model at the first stage. Following Zhou et al. (2017), *IV_Aca* is instrumental variable measured by average industry C.E.O. with academic experience in the previous year. We use the kernel matching method to match samples with academic C.E.O.s and without academic C.E.O.s and obtain matched samples. *SGR* is the measure of sustainable growth rate estimated using Higgin's model (Higgins, 1977). ***, ** and * denote significance levels at 1%, 5%, and 10%, respectively.
Source: CSMAR database and open data.

4.4.2. An alternative measure of sustainable growth

Higgins's (1977) sustainable growth rate model is relatively simple and easy to calculate. However, it does not consider dynamic growth issues. Therefore, to enhance the robustness of our conclusions, we use Van Horn's (1988) sustainable growth rate model (income retention rate × return on net assets/(1 − income retention rate × return on net assets)) as an alternative measurement of sustainable growth. Table 6 shows the results. The coefficient of C.E.O. academic experience (*Academic*) of the full sample is still significant at the 5% level. And the coefficient of C.E.O. academic experience (*Academic*) in high-tech firms is more pronounced than non-high-tech firms. Our results are robust.

4.5. Potential mechanism analysis

4.5.1. Innovation

Academic experience will promote C.E.O.s' spirit of keeping improving and innovation. Shen et al. (2020) found that academic C.E.O.s have spirits of innovation, they advocate firm long-term profitability and innovation. C.E.O.s with academic experience are considered to be more active in innovation and have a higher tolerance for innovation failure. And C.E.O.s with academic experience tend to make innovation decisions from firm long-term benefits (Zhang, 2019; Zhang et al., 2021). Academic C.E.O.s are more self-discipline and make higher requirements for the quality of company information disclosure, which lowers the degree of information asymmetry between a company and outside stakeholders (such as creditors and investors), and reduces the cost of debt financing, and ease financing constraints (Redfern, 2004). Firms with a lower cost of debts and easing financing constraints tend to have higher innovation input (Lyandres & Palazzo, 2016). Therefore, we predict that C.E.O. academic experience will help increase corporate R&D investment.

Table 6. An alternative measure of sustainable growth.

Variables	(1) Full sample SGR_New	(2) Hightech = 0 SGR_New	(3) Hightech = 1 SGR_New
Academic	0.004***	0.005*	0.003**
	(3.15)	(1.92)	(2.23)
NonCEOAcademic	0.001	−0.004	0.002
	(0.93)	(-1.56)	(1.64)
Financial	−0.001	0.005*	−0.006*
	(-0.43)	(1.67)	(-1.84)
Overseas	0.002	0.008**	−0.000
	(1.24)	(2.40)	(-0.15)
Military	−0.012	−0.010	−0.014
	(-1.36)	(-1.06)	(-1.04)
Other controls	Yes	Yes	Yes
Constant	−0.272***	−0.357***	−0.219***
	(-10.92)	(-8.20)	(-7.39)
Ind FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	16,127	5,838	10,289
Adjusted R^2	0.639	0.596	0.673
F-value	185.94	77.07	209.07

Notes: *SGR_New* is the alternative measure of sustainable growth rate using Van Horn's model (Van Horn, 1988). ***, ** and * denote significance levels at 1%, 5% and 10%, respectively.
Source: CSMAR database and open data.

Through R&D investment, firms can upgrade products and technologies, reduce costs, and improve quality, thereby improving operating performance and operating efficiency, and enhancing corporate competitiveness (Zhu & Zhang, 2013). Moreover, R&D investment can enhance firms' ability to learn and apply knowledge and skills in the industry, achieving sustainable growth (Gustavsson et al., 1999). Therefore, we predict that R&D investment plays a mediating role in the C.E.O.'s academic experience and sustainable growth. The C.E.O.'s academic experience can enhance the company's sustainable growth ability by increasing R&D investment.

We use two measures as a proxy for firm innovation input (R&D_1: percentage of R&D expenses on the total asset; R&D_2: percentage of R&D on sales revenue) referring to Brown et al. (2009) and Pan et al. (2015). Other variable definitions are the same as above. Control variables are the same with equitation (1). Panel A of Table 7 presents the results. Columns (1) to (3) show the results for percentage R&D expenses on total asset (R&D_1) and Columns (4) and (5) show the results for R&D expenses to total operating income (R&D_2). Results suggest that R&D investment plays the part of the intermediary effect of C.E.O. academic experience and the company's sustainable growth ability. We further use Sobel (1982) test. The Sobel test results show that Academic is significantly positively with firm S.G.R. Z values are 3.813 and 3.377, respectively and both P values are less than 0.001, mediating effect ratio is 5.01% and 6.19%, respectively. It shows that corporate R&D investment has a partial mediating effect on C.E.O. academic experience and corporate sustainable growth.

4.5.2. Internal control

Academic C.E.O.s tend to have relatively higher ethics and standards of social responsibility (Cho et al., 2017; Francis et al., 2015; O'Connell, 1998; Tierney, 1997). Higher ethics and standards of social responsibility are key determinates serving to shape the

Table 7. Mediating effect of innovation input and internal control.

Panel A Mediating effect of innovation input

Variables	(1) Path A SGR	(2) Path B RD_1	(3) Path C SGR	(4) Path B RD_2	(5) Path C SGR
RD_1			0.209***		
			(5.72)		
RD_2					0.078***
					(5.53)
Academic	0.004***	0.002***	0.003***	0.003***	0.003***
	(3.09)	(5.08)	(2.81)	(4.67)	(2.87)
NonCEOAcademic	0.001		0.001	0.008***	0.001
	(1.29)		(0.74)	(12.25)	(0.74)
Financial	−0.001	−0.002***	−0.000	−0.004***	−0.000
	(-0.25)	(-6.49)	(-0.04)	(-5.48)	(-0.10)
Overseas	0.002	0.001*	0.002	0.004***	0.002
	(1.19)	(1.94)	(1.07)	(3.47)	(1.00)
Military	−0.012	−0.000	−0.012	−0.003	−0.012
	(-1.32)	(-0.37)	(-1.31)	(-1.34)	(-1.30)
Other controls	Yes	Yes	Yes	Yes	Yes
Constant	−0.216***	0.025***	−0.221***	0.052***	−0.220***
	(-9.23)	(8.51)	(-9.37)	(9.22)	(-9.42)
Ind FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	16,127	16,127	16,127	16,127	16,127
Adjusted R^2	0.512	0.332	0.513	0.372	0.512
F-Value	105.75	297.23	111.30	238.43	103.50
Sobel Test		Z = 3.813	$p < 0.001$	Z = 3.377	$p < 0.001$

Panel B: Mediating effect of internal control quality

Variables	(1) Path A SGR	(2) Path B IC	(3) Path C SGR
IC			0.047***
			(5.25)
Academic	0.004***	0.005***	0.003***
	(3.07)	(3.39)	(2.87)
NonCEOAcademic	0.001	0.006***	0.001
	(0.95)	(4.79)	(0.69)
Financial	−0.001	0.000	−0.001
	(-0.24)	(0.01)	(-0.24)
Overseas	0.002	0.001	0.002
	(1.13)	(0.29)	(1.11)
Military	−0.012	−0.013**	−0.011
	(-1.30)	(-2.26)	(-1.24)
Other controls	Yes	Yes	Yes
Constant	−0.227***	−0.125***	−0.221***
	(-9.42)	(-8.30)	(-9.25)
Ind FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	15,936	15,936	15,936
Adjusted R^2	0.505	0.180	0.506
F-Value	100.32	80.31	98.23
Sobel Test	Z = 2.936	$p = 0.003$	

Notes: Referring to Brown et al. (2009), we use percentage of R&D expenses on the total asset *(RD_1)* as a proxy for firm innovation. *RD_2* is another proxy for firm innovation input percentage of R&D on sales revenue referring to Pan et al. (2015). *IC* is an internal control quality index constructed by the Internal Control Research Center of Xiamen University (Chen et al., 2017; Ge et al., 2021). The index falls within the five main aspects of internal control proposed by COSO: (1) Control Environment, (2) Risk Assessment, (3) Control Activities, (4) Information and Communication and (5) Monitoring. ***, ** and * denote significance levels at 1%, 5% and 10%, respectively.
Source: CSMAR database and open data.

internal control environment and achieve high-quality internal control (Xu & Ma, 2022). And academic C.E.O.s are more conservative as academic work requires preciseness and diligence. Internal control functions by managing risk, C.E.O.s with more risk aversion or greater competence in risk management, conceivably owing to their academic experience, contribute to producing a risk-averse internal control environment and effective risk management measures, thus enhancing the internal control quality of their firms (Wang et al., 2019).

Effective internal control can constrain opportunistic behaviors of management and thus promote firm long-term growth (Acharya et al., 2011; Bushman & Smith, 2001; Jensen, 1993). As a protection mechanism, effective internal control can protect the interests of investors and thus decrease firms' cost of equity capital (Beneish et al., 2008; Dhaliwal et al., 2011). Firms with a lower cost of equity capital obtain comparative advantages in resource allocation to create value and competitiveness (Wang et al., 2019). Effective internal control also assures quality and efficiency of firm information and thus leads to more efficient investment and operation. The efficiency of investment and operation is vitally important for a firm's long-term development. Therefore, we predict internal control quality to play an intermediary role in the effect of academic C.E.O.s and firm sustainable growth.

We use the internal control quality index (*IC*) as a proxy of internal control quality referring to Ge et al. (2021). Panel B of Table 7 presents the results.

5. Conclusions and implications

5.1. Conclusions

This study investigates whether C.E.O. academic experience affects firm's sustainable growth, using data on Chinese firms from the period of 2010–2017. The results indicate that C.E.O.'s academic experience has positive effect on firm's sustainable growth. Further, the positive effect of academic experience on firm's sustainable growth is more pronounced in high-tech firms. By exploring the transmission channels, the results generally imply that C.E.O.'s academic experience can influence corporate innovation by improving R&D investment and internal control. This is the first empirical evidence in support of the association between C.E.O.'s academic experience and corporate sustainable growth.

5.2. Implications

The findings of this paper have the following key implications. Firstly, since C.E.O.'s academic experience promotes corporate sustainable growth, firms should attach more importance to the intangible resources brought by the C.E.O.'s academic experience, transform them into innovative performance, enhance the firm's core competence, and achieve sustainable development. Secondly, enterprises should give full play to the role of academic C.E.O.s in corporate governance. We find that the C.E.O.'s academic experience can help shape internal self-discipline and supervision mechanisms, promote innovation input and promote sustainable development. Thirdly, as there is a worldwide

tendency that scholars are encouraged to start up their own business, our study provides empirical evidence for the rationale and benefits of this policy.

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