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Nexus Between Intellectual Capital and Sustainable Growth: Moderating Roles of Military-Experienced CEOs and Sustainable Corporate Governance

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Abstract: This study explores the nexus between intellectual capital (IC) and the sustainable growth rate (SGR), with a unique emphasis on the moderating roles of military-experienced CEOs (MCEOs) and sustainable corporate governance (SCG). We utilize the Method of Movement Quantile Regression Analysis (MMQR) with data gathered from 750 Chinese non-financial firms listed on the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE) from 2010 to 2022. The findings indicate that IC exerts a favorable and significant influence on the SGR across various quantiles. Furthermore, across multiple quantiles, the SGR exhibits a positive and strong correlation with capital employed efficiency (CEE), human capital efficiency (HCE), and structural capital efficiency (SCE). Moderation analysis reveals that MCEOs and SCG demonstrate a positive correlation between IC and the SGR. The results extend our understanding of how MCEOs and SCG can enhance the SGR through effective IC utilization.

Keywords: intellectual capital; sustainable growth; military CEOs; corporate sustainability; quantile analysis

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1. Introduction

The significance of intellectual capital (IC) in modern socio-economic growth is a highly contested topic [1,2]. In this advanced era, communities must confront four socio-economic phases: primitive, agricultural, industrial, and information [3]. In the initial three phases, land, buildings, and equipment are deemed crucial for corporate development [4]. The fourth stage depends on contemporary policies and tactics concerning intangible assets rather than tangible assets [5]. Consequently, businesses ought to regard intellectual capital as crucial in augmenting their competitive capability and attaining corporate success to engage researchers and practitioners [6–9]. According to the resource-based view theory (RBV), firms possessing valuable and rare resources can achieve a durable competitive advantage [10–12]. These resources enable firms to sustain human capital, enhance operations, engage customers and suppliers, and foster increased innovation [13]. Consequently, in the contemporary knowledge-driven economy, intellectual capital is regarded as essential for company competitiveness and financial sustainability [14].

Sustainability has consistently been a prominent subject in academic discourse [15–18]. Business sustainability is linked to sustainable development, corporate social responsibility (CSR), and corporate citizenship [17]. In a broader framework, social, environmental, and economic imperatives are seen as the three fundamentals of business sustainability [19].

Consequently, financial management has focused on the relationship between actual business operations and a sustainable financial performance. Managers do not completely comprehend the firm's long-term sustainable development potential, particularly the impact of IC on sustainable growth, as they are primarily focused on the financial performance [16]. Consequently, to attain business sustainability, it is essential to examine the relationship between intellectual capital and company sustainability within the knowledge economy [9].

Most intellectual capital research has concentrated on publicly traded firms in developed economies, including the USA, UK, Canada, and Australia [19]. This study has solely focused on publicly traded firms in China's growing economy. As Chinese firms are increasingly competing globally, understanding how they leverage intellectual capital can play a vital role in assessing their competitiveness. Research in this area can drive strategies for national and international firms looking to enhance their performance through effective IC management [20].

The relationship between IC and the sustainable growth rate (SGR) is complex. It is crucial to examine the impact of additional variables in this relationship [3]. The MCEOs and sustainable corporate governance (SCG) may impact this relationship. Previous research proposes the influence of CEOs with academic expertise on sustainable growth [21], but neglects the effect of chief executive officers with military experience on sustainable growth. This study concentrates on MCEOs due to their military attributes, such as effective communication and decision-making skills, proficient supervision, persistence in goal attainment, and heightened ethical standards, as elaborated in the studies by [22–24].

According to the organization's governance framework, a corporation intends to fulfill its aims and objectives [25]. Therefore, it can be asserted that IC with the SGR is intricate and may be contingent upon numerous governance issues. This study also concentrates on sustainable corporate governance (SCG) as it fosters responsible and ethical company practices, ensuring long-term resilience and success. This study incorporates SCG proxies such as ESG disclosure (ESG_D), environmental disclosure (ENV_D), social disclosure (SOC_D), and governance disclosure (GOV_D), which were previously overlooked from this perspective [26]. To the authors' knowledge, there is a lack of research examining the influence of governance traits as a moderating variable concerning intellectual capital [27].

This study seeks to empirically investigate the relationship between intellectual capital (IC) and the sustainable growth rate (SGR) in Chinese non-financial firms, using newly proposed moderating factors such as MCEOs and SCG. Additionally, we examine the influence of certain components of IC on the SGR using moderating variables. Therefore, this paper contributes to the existing body of literature in four distinct ways. Firstly, this study builds upon previous studies by evaluating the influence of intellectual capital on the sustainable growth rate of Chinese non-financial firms. Secondly, we present evidence of the relationship between intellectual capital (IC) and the sustainable growth rate (SGR), with the moderating influence of MCEOs in Chinese enterprises for the first time. This research enhances the literature by introducing a novel moderator that has not been previously investigated by prior studies examining the influence of military-experienced executives on business decision making [22,28].

Thirdly, we demonstrate the relationship between IC and the SGR through another innovative moderation of SCG for Chinese non-financial firms. Environmental, social, and governance (ESG) factors have become significant in addressing many stakeholders' objectives regarding company sustainability and corporate social responsibility (CSR) measures [29,30]. Finally, this study uses an innovative technique known as the MMQR to examine the relationship between IC and the SGR.

The subsequent sections of this work are structured as follows. Section 2 presents a review of the literature and the formulation of hypotheses. Section 3 focuses on the research methods of the study. Section 4 delineates the empirical findings. And Section 5 pertains to the conclusion and future research directions of the study.

2. Literature Review and Hypothesis Development

2.1. Definition and Measurement of Intellectual Capital (IC)

The academician presents many perspectives on IC and its constituents. However, there remains no consensus on its precise description [31,32]. IC is an integrated idea encompassing various disciplines, including managerial accounting, financial leadership, and philosophy. Edvinsson and Malone [33] characterize IC as a knowledge asset capable of transforming into tangible goods. Stewart [34] characterized IC as intellectual assets, including knowledge, information, intellectual creativity, and experience, capable of transforming into wealth. Ozkan Cakan [35] asserts that enterprises utilize IC as a knowledge-based asset for reporting purposes, acquiring a competitive advantage, and transforming information into profit. According to another definition, IC is an intangible asset not appearing on the entity's financial statements. Still, effective management can give the organization a competitive advantage over time [36,37].

The literature indicates that researchers have not established an acceptable universal definition for the components of IC [35]. Initial research identified human capital (HC) and structural capital (SC) as essential elements of IC. The foundations of HC include an employee's education, skills, knowledge, expertise, and intellect [38]. According to Bayraktaroglu Calisir [31], the intrinsic implicit nature of knowledge makes HC the most esteemed element of IC. Organizations prioritize investments in human capital to enhance productivity, achieve cost savings, and foster innovation. Joshi Cahill [39] characterizes experience as a constituent of human capital, which employers can enhance and disseminate at both individual and organizational levels. According to Vo and Tran [40], structural capital (SC) encompasses internal organizational capital. It comprises the organizational structure, systems, frameworks, and innovations necessary to sustain the firm's capabilities. It enables firms to generate wealth by developing long-term intellectual property and empowering employees [41]. SC is a framework that allows an organization to facilitate HC [42]. Bayraktaroglu Calisir [31] declares that SC is crucial for human capital to leverage, disseminate, and communicate knowledge inside the organization to generate value.

The measurement of IC has garnered significant research interest. Researchers have developed a variety of methodologies to assess intellectual capital, such as the Skandia Navigator [43], the Intangible Assets Monitor [44], the IC Index [45], Tobin's Q [34], EVA Stewart's 1991 [35], and the Value-Added Intellectual Coefficient model (VAIC) [46]. The VAIC model is the most commonly utilized framework for assessing intellectual capital efficiency. This methodology facilitates effective comparisons among enterprises and countries by efficiently calculating and standardizing [47]. Secondly, the data are derived from audited financial statements to compute the VAIC [47]. Consequently, the present study aims to utilize the VAIC to illustrate its influence on a firm's sustainable growth rate (SGR). The previous findings suggest that the VAIC significantly boosts a firm's sustainable growth rate (SGR).

2.2. Theoretical Framework

The resource-based view (RBV) theory articulates the debate on the significance of intellectual capital (IC) in establishing and sustaining a firm's growth. RBV theory contends that intellectual capital is central to value generation and competitive advantages [14]. Furthermore, Barney [14] contended that an organization's capacity to cultivate significant and distinctive human capital assets and utilize them effectively is inherently linked to a persistent competitive advantage. The effective utilization of a firm can yield benefits such as a cost reduction and enhanced performance [48,49]. Nonetheless, insufficient organization and execution render individual capabilities incapable of providing a competitive advantage [50].

At this point, the CG establishes its connection to the IC. CG is accountable for the efficient administration of intellectual capital embedded within the enterprise's personnel, organizational structure, and processes [51]. However, very few studies have examined how corporate governance influences internal controls' effective implementation and ongoing

sustainability [38]. Consequently, this study posits, from the perspective of the RBV theory, that the MCEO and SCG are critical components of CG, exerting a positive and significant moderation between IC and SGR.

Agency theory provides a fundamental basis for examining the relationship between IC and SGR, with MCEO and SCG acting as moderators. Agency theory posits that the interests of managers align with those of shareholders [52]. This resulted in an agency problem when managers neglected the interests of shareholders [53]. The primary aim of corporate governance is to ensure that business activities adhere to established regulations and ethical standards, thereby regulating managers' opportunistic activities and excessive risk-taking behavior. The efficient oversight of corporate governance diminishes agency costs and generates profit for relevant shareholders. Value creation enhances not just financial capital, but also physical and intellectual capital. Therefore, we regard CG as a crucial factor that augments the firm's physical and intellectual resources [38]. Thus, based on agency theory, this study hypothesizes that MCEO and SCG positively and significantly moderate the nexus between IC and the SGR.

2.3. Intellectual Capital (IC) and Sustainable Growth Rate (SGR)

Penrose [51] introduced the "resource-based view theory (RBV)," which was further expanded by [52], indicating that firms might attain a competitive advantage through various tangible and intangible assets. In the contemporary period, companies are expected to prioritize intangible assets. These intangible assets contribute to the corporate performance by gaining significance [53]. Shah, Lai [54] asserts that organizational competitiveness hinges on managing valued, distinctive, and challenging resources to duplicate. These resources are essential for quality product development and stakeholder satisfaction, critical components of the company's operations [25]. Intellectual capital is rapidly gaining recognition as a firm's significant intangible asset [3]. Soewarno and Tjahjadi [55] assert that intellectual capital is a proactive strategy to foster employee innovation and advance the firm beyond its competition. Consequently, intellectual capital is receiving considerable attention in knowledge-based enterprises due to their substantial reliance on knowledge and human expertise [56]. Chowdhury, Rana [57] contended that intellectual capital is crucial for seamless financial advancement due to its increased necessity in the sustainable development of firms and innovation.

In 1977, Higgins [58] proposed the concept of the SGR. It is the maximum rate at which a corporation refrains from borrowing from external sources, such as banks or financial institutions, and instead utilizes its internal resources. Companies that effectively manage their SGR can preserve financial resources and prevent excessive financial leverage [9]. Firms can foster creative practices and sustainable business models by effectively managing knowledge. Consequently, firms can align their strategies with the Sustainable Development Goals (SDGs) and augment their entrepreneurial orientation toward sustainability by utilizing intellectual capital [59]. Intellectual capital is associated with the generation of long-term value. Organizations that effectively leverage their intellectual resources can achieve superior financial performance and sustainability results [60]. Furthermore, Sohel Rana and Hossain [61] proclaim that firms emphasizing their intellectual capital can distinguish themselves in the marketplace, resulting in a competitive advantage that fosters sustained growth. It is particularly crucial for individuals for whom creativity and adaptability are essential.

Xu and Wang [9] identified a positive and strong correlation between intellectual capital and sustainable growth. A study of the Dhaka Stock Exchange (DSE) which listed non-financial enterprises indicated a beneficial impact of intellectual capital on sustainable growth. This research showed that factors like human and structural capital efficiency significantly impact the corporate performance and sustainable growth [61]. Vale, Miranda [60] emphasized the correlation between intellectual capital and sustainable growth, demonstrating that human, structural, and relational capital investments enhance sustainability outcomes. Alipour [62] contended that intellectual capital is essential for sustained

growth and a competitive advantage. Zhang and Wang [63] asserted that a superior IC performance correlates with enhanced sustainable growth and investor confidence based on their analysis of listed manufacturing firms in China from 2015 to 2020. Xu and Wang [9] also documented a significant beneficial effect of VAIC on the SGR. However, Smriti and Das [64] identified a negative correlation and minimal impact between the VAIC and SG.

H1A: *There is a positive nexus between the VAIC and SGR in Chinese firms.*

The efficient utilization of tangible and intellectual resources is crucial for achieving sustainable growth [61]. Furthermore, Smriti and Das [64] discovered that elevated capital employed efficiency (CEE) improves company Sustainable Growth (SG) by examining 15 Indian banking institutions from 2001 to 2016 using a Generalized Method of Moments (GMM) techniques. Conversely, Kasoga [65] and Hasan and Miah [66] reported opposing findings. Human capital is the paramount intellectual capital asset, significantly influencing the overall efficiency [67].

H1B: *There is a positive nexus between CEE and the SGR in Chinese firms.*

Human capital efficiency (HCE) and the Value Added Intellectual Coefficient (VAIC) exhibit a consistent relationship, and most studies affirm this assertion [68,69]. Xu and Wang [9] asserted that HCE positively and significantly impacts the SGR by analyzing data from 390 manufacturing enterprises in Korea between 2012 and 2016, employing a fixed effects model. Lu and Li [70] similarly discovered congruent results in the investigations conducted in Pakistan and China. However, Smriti and Das [64] found that HCE insignificantly influences sustainable growth.

H1C: *There is a positive nexus between HCE and the SGR in Chinese firms.*

Structural capital is a unique asset for an organization that differs from one entity to another. Each organization possesses its distinct culture, ideology, processes, and databases. Consequently, management must meticulously oversee these unique resources for sustainable growth [61]. In this regard, numerous studies have demonstrated that the optimal utilization of SC enhances sustainable growth [65,70,71]. Hasan and Miah [66] determined the detrimental impact of SC on SG. Figure 1 is a graphical depiction of the hypothesis and leads to the development of the following hypothesis.

H1D: *There is a positive nexus between SCE and the SGR in Chinese firms.*

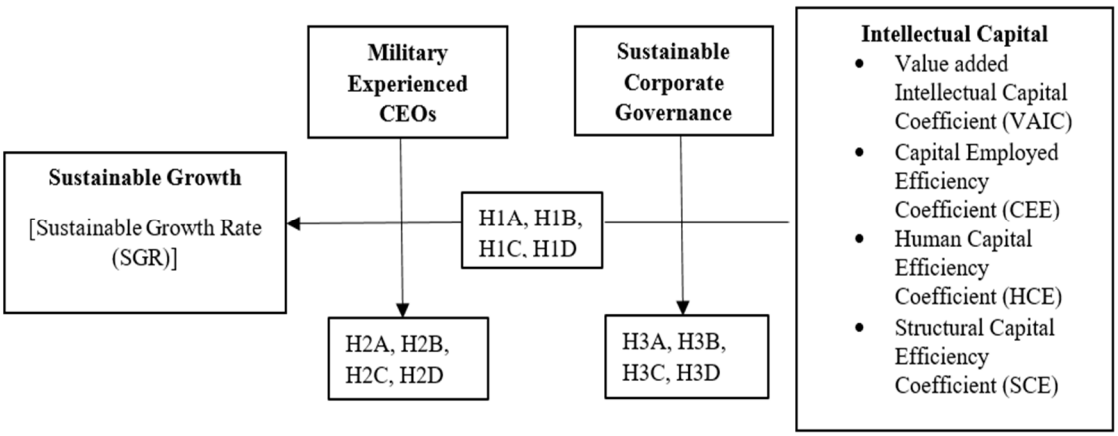


Figure 1. Variables nexus and graphical hypothesis.

2.4. Moderating Roles of Military-Experienced CEOs and Sustainable Corporate Governance

In 1976, Jensen and Meckling [72] introduced agency theory to elucidate and examine the connection between principals and agents in contexts of knowledge asymmetry, uncertainty, and risk. Agency theory elucidates methods to resolve the contentious relationship between principals (shareholders) and agents (management) [3]. Although principals expect agents to act on their behalf, opportunistic conduct may cause their interests to diverge. Consequently, managers and shareholders are perpetually in intrinsic conflict [73]. Agency theory posits that corporate governance is essential for mitigating conflicts of interest and incentivizing managers to act in the interests of shareholders [74]. Consequently, efficient monitoring and control procedures via corporate governance can effectively safeguard shareholder interests [3]. This suggests that MCEOs and SCG may be crucial for managing IC, an aspect previously overlooked.

The effectiveness of IC in influencing the SGR is subject to the moderation of corporate governance (CG), particularly through the pivotal factor of MCEOs. Can leadership, especially military leaders, be important for the organizational performance? This topic is relevant in academics. Organizational theorists describe the role of individual leadership in the performance of an organization [75] and care about the behavior of leadership [76]. This study extends the literature on military leadership and finds that service in the military is associated with overconfidence, aggressiveness, and risk-taking [77–79]. Service in the military is linked to a value system that promotes integrity and ethics [22]. Military experience may also help CEOs handle pressure and decide under stressful situations [22].

Moreover, military CEOs understand the importance of the continuous training of employees. They also understand the value of investing in human capital, which leads to higher engagement and retention rates. This focus of MCEOs not only enhances the employee performance, but also the overall success of the organization.

Military personnel on the board of directors will likely establish a moral value system prioritizing ethics, integrity, and commitment. Rather than pursuing their self-interest, they exhibit greater dedication, reliability, and loyalty to their organizations, sacrificing personal gain to uphold ethical standards [75]. Furthermore, Franke [75] asserts that MCEOs possess exceptional managerial and decision-making abilities, especially under challenging circumstances characterized by heightened ambiguity. This results from their previous systematic, intensive job training and battle experience, which enhance their efficiency in high-risk and high-pressure situations. Moreover, the logical reasoning of CEOs (e.g., military experience) can improve the organizational, ownership, and shareholder structures, resulting in superior corporate governance [76]. Enhanced-quality corporate governance correlates favorably with a firm's sustainable growth [77]. Consequently, we propose that the beneficial impact of IC on the SGR is expected to be more pronounced through MCEOs. Therefore, we suggest the following hypotheses:

H2A: *MCEOs positively moderate the nexus between the VAIC and SGR in Chinese firms.*

H2B: *MCEOs positively moderate the nexus between CEE and the SGR in Chinese firms.*

H2C: *MCEOs positively moderate the nexus between HCE and the SGR in Chinese firms.*

H2D: *MCEOs positively moderate the nexus between SCE and the SGR in Chinese firms.*

The role of SCG is crucial in shaping the relationship between IC and the SGR. Companies adopting sustainable governance principles will likely generate long-term benefits for shareholders and society. Furthermore, by integrating sustainability into their fundamental strategy, these firms can achieve an enhanced financial performance while favorably impacting the environment and society [78]. Furthermore, previous studies indicate that organizations with board members possessing sustainable experience tend to make more equitable and sustainable decisions by considering the impacts on diverse stakeholders [79],

which leads to an enhanced sustainability performance and share price [80–82]. Consequently, we anticipate that SCG will positively influence the relationship between IC and the SGR. Consequently, the following hypotheses are established:

H3A: *SCG positively moderates the nexus between the VAIC and SGR in Chinese firms.*

H3B: *SCG positively moderates the nexus between CEE and the SGR in Chinese firms.*

H3C: *SCG positively moderates the nexus between HCE and the SGR in Chinese firms.*

H3D: *SCG positively moderates the nexus between SCE and the SGR in Chinese firms.*

3. Research Methodology

3.1. Population and Sample

The sample comprised all companies listed on the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE) between 1 January 2010 and 30 December 2022. We employed certain filters to ensure the accuracy of the accounting data. Thus, this study focuses exclusively on non-financial enterprises and omits financial firms due to their distinct capital structure characteristics [83]. Secondly, the current study specifically examined publicly traded firms' "A" class shares. The restriction in China, which forbids the general public from investing in non-floating B- or H-class shares, led to this choice [84]. This limitation guarantees that the investigation was confined to the floating shares accessible for public investment.

Initially, we collected data for a total of 1946 firms. However, due to the restricted availability of environment, social, and governance (ESG) data, we lowered the sample size to 750 companies, resulting in 9750 observations. Only after 2010 did these data become available, which is crucial for formulating sustainable corporate governance.

3.2. Variable Description and Data Source

The current study has used sustainable growth as a dependent variable and intellectual capital as an independent variable while also considering the moderating effects of MCEOs and SCG. Pulic [46] and Pulic [85] created the value-added intellectual capital coefficient (VAIC) as a quantitative measuring scale. The following factors determine the calculation of intellectual capital:

$$\text{VAIC} = \text{CEE} + \text{HCE} + \text{SCE} \quad (1)$$

$$\text{CEE} = \text{VA}/\text{CE} \quad (2)$$

$$\text{HCE} = \text{VA}/\text{HC} \quad (3)$$

$$\text{SCE} = \text{SC}/\text{VA} \quad (4)$$

Equation (1) defines CEE as the capital employed efficiency coefficient, HCE as the human capital efficiency coefficient, and SCE as the structural capital efficiency coefficient. Equation (2) calculates total value added (VA) by subtracting the total expenses from the total income. CE stands for Capital Employed, which includes both physical and financial capital. We calculate it by subtracting total liabilities from total assets. Employee salaries and wages determine human capital (HC) quantification in Equation (3). Equation (4) defines SC as the difference between VA and HC, where SC represents the measure of structural capital. This study aims to analyze the impact of intellectual capital on sustainable growth, considering the moderating effects of MCEOs and SCG. The control variables employed in this study include firm size, board size, and state-owned firms.

The China Stock Market and Accounting Research (CSMAR), widely recognized as the leading and trustworthy provider of financial and economic data in China, provided the data for this study. Notably, 75% of qualified foreign institutional investors and 90% of Chinese financial institutions operating in China rely on CSMAR data facilities. Following

Liu and Stambaugh [86], the results of this database are reliable, accurate, and transparent. Table 1 provides a comprehensive overview of all of these variables.

Table 1. Variable Description and Measurement.

Variable	Capacity	Symbol	Formula	Duration	References
Sustainable Growth Rate	Dependent Variable	SGR	Net Profit Ratio × Asset Turnover Ratio × Retention Rate × Equity Multiplier (Assets to Equity)	2010–2022	Xu and Wang [9]
Intellectual Capital	Independent Variable	IC	VAIC = CEE + HCE + SCE	2010–2022	Shah, Lai [3]
Military CEOs	Moderator	MCEOs	A dummy variable that takes the value of one if the CEO has military experience (current or retired military experience) and zero otherwise.	2010–2022	Ullah, Fang [87]
Sustainable Corporate Governance	Moderator	SCG	**1.** ESG disclosure (ESG_D) = Company's ESG transparency based on 178 critical ESG publicly disclosed measures. All disclosure scores range from 0 (no disclosure of ESG information) to 100 (full disclosure of information). **2.** Environmental disclosure (ENV_D) = Based on 61 environmental disclosure indicators. All disclosure scores range from 0 (no disclosure of ESG information) to 100 (full disclosure of information). **3.** Social disclosure (SOC_D) = Based on 63 social disclosure indicators. All disclosure scores range from 0 (no disclosure of ESG information) to 100 (full disclosure of information). **4.** Governance disclosure (GOV_D) = Based on 54 governance disclosure indicators. All disclosure scores range from 0 (no disclosure of ESG information) to 100 (full disclosure of information).	2010–2022	Nicolò, Zampone [88]
Firm Size	Control Variable	F.Size	Natural logarithm of total assets at year-end	2010–2022	Xu and Wang [9]
Board Size	Control Variable	B.Size	Number of directors sitting on board.	2010–2022	Zampone [89]
State-owned Enterprises	Control Variable	SOEs	A binary variable is if the firm is state owned, then one; otherwise, it is zero.	2010–2022	Ullah, Fang [87]

Notes: This table comprehensively lists the dependent, independent, and control variables. The yearly data for the dependent and control variables are sourced from China Stock Market and Accounting Research (CSMAR).

3.3. Model and Data Estimation Methods

3.3.1. Cross-Sectional Dependency Test

The cross-sectional dependence (CD) test is employed to identify cross-sectional dependency in panel data. The CD test is conducted using Pesaran's CD test framework,

as described by [90]. The CD test utilizes a residual cross-sectional augmented (CSDA) test regression, demonstrated by Equation (5).

$$\Delta\widetilde{y}it = \rho\widetilde{y}it - 1 + \sum_{j=1}^{N} \gamma_j \Delta\widetilde{y}jt - 1 + \sum j = 1^N \beta_j \widetilde{X}ijt - 1 + \epsilon it \quad (5)$$

In the above equation, the symbol Δ represents the first difference operator. A $\widetilde{y}it$ is referred to as the transformed dependent variable, while $\widetilde{X}ijt - 1$ represents the transformed independent variable. The parameter ρ denotes the autoregressive parameter, and γ_j represents the coefficients for cross-sectional lags. The coefficients for independent variables are denoted by β_j, and the error term is represented by ϵit. The symbol $\sum j = 1^N$ represents the sum across all independent variables from 1 to N. N denotes the total number of cross-sectional units, while i and t represent the unit and time dimensions, respectively. Moreover, -1 donates a lagged variable. Equation (6) displays the CD test statistics derived from the residual sum of squares (RSS).

$$CD = T\frac{\sum_{i=1}^{N}\sum_{t=1}^{N}\hat{e}it^2}{\sigma^2\sum i = 1^N\sum_{t=1}^{T}\hat{v}_{it}^2} \quad (6)$$

where T represents the number of periods, $\hat{e}$ represents the residuals obtained from the CSDA regression, σ^2 represents the mean squared error obtained from the CSDA regression, and $\hat{v}$ represents the residuals obtained from the OLS regression of $\widetilde{y}it$ on the cross-sectional means of $\widetilde{y}i$ and $\widetilde{X}_{ij}$ [91]. The equation evaluates the model's performance by comparing the sum of the squared residuals to the variance of the estimated values.

The CD test indicates a normal distribution when we assume the null hypothesis of no cross-sectional dependency. If the CD test statistic exceeds the critical value, it means that there is strong evidence of cross-sectional dependency and suggests that the observations are not independent. Thus, we refute the null hypothesis. One can employ spatial econometric models or panel data models to address the cross-sectional dependency in this scenario. Conversely, suppose the CD test statistic is less than or equal to the critical value. In that case, it demonstrates that there is no cross-sectional dependency and that the observations are independent of each other. It leads to accepting the null hypothesis [91].

3.3.2. Panel Unit Root Tests

We employ panel unit root tests to ascertain the presence of stationarity in panel data. Econometric techniques are based on the fundamental assumption of stationarity. A random trend in the individual time-series within panel data might lead to misleadingly significant relationships between variables. First-generation unit root tests and second-generation unit root tests are the two most commonly used panel root tests to assess unit roots in panel data.

We employ first-generation unit root tests to evaluate the stationarity or presence of a unit root in the panel data. However, they disregard the cross-sectional dependency in panel data settings, which can lead to biased and inaccurate estimations. The first-generation tests include the Im, Pesaran, and Shin (IPS), the Levin, Lin, and Chu (LLC), and the Fisher-type tests. Equation (7) represents the first test of unit generation.

$$y_{it=}\alpha_{i0} + \rho_i y_{it-1} + \epsilon_{it} \quad (7)$$

where y_{it} is the variable of interest for a country at time i and at time t, ϵ_{it} is the error term, ρ_i is the autoregressive parameter, and $t = 1, \ldots, T$ and $i = 1, \ldots, N$.

The null hypothesis of the first-generation unit root test suggests the presence of a unit root in the panel data. We accept our null hypothesis if the autoregressive value equals 1, indicating the presence of a unit root in the panel data. If the autoregressive parameter is less than 1, we reject the null hypothesis, suggesting that no unit root exists in the panel

data. We employ second-generation unit root tests to evaluate the stationarity of the panel data. Additionally, we address the issue of cross-sectional dependency in panel data, resulting in more precise estimations of the unit root features. In the second-generation category, additional tests include the CD (Choi) test, the Pesaran [92] test, and the Maddala and Wu (MW) test. We administer the second-generation test using Equation (8).

$$y_{it} = \beta_{i0} + \beta_{i1} z_i + \gamma_i y_{i,t-1} + \epsilon_{it} \quad (8)$$

where z_{it} is a common factor, γ_i refer to a company-specific autoregressive parameter, and $t = 1, \ldots, T$ and $i = 1, \ldots, N$. The null hypothesis of the second-generation test suggests the presence of a unit root in the panel data. If the autoregressive value is equal to 1, accepting our null hypothesis implies the presence of a unit root in the panel data. If the null hypothesis is less than 1, it indicates the absence of a unit root. Thus, we refute the null hypothesis [91].

3.3.3. OLS Regression with One-Way and Two-Way Fixed Effect

This study employed OLS regression to assess the correlation between sustainable growth and intellectual capital, accounting for the moderating influence of CEOs with military experience and sustainable corporate governance. In addition, we employed a one-way fixed effect model using OLS regression to address unobserved time heterogeneity and incorporate firm-specific effects. We also employed a two-way fixed effect model with ordinary least squares (OLS) regression to mitigate the impact of intangible differences. It is accounted for in both firm-specific and time-specific effects [91]. Panel "A" in Table 2 presents the empirical model developed using one-way fixed effects, whereas "B" refers to the empirical model developed using two-way fixed effects.

Table 2. Regression Model Estimation.

Panel A: One-Way Fixed Effect	
Model 1	$SGR_{it} = \alpha_i + \beta_1 VAIC_{it} + \beta_2 F.Size_{it} + \beta_3 B.Size_{it} + \beta_4 SOEs_{it} + \epsilon_{it}$
Model 2	$SGR_{it} = \alpha_i + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 F.Size_{it} + \beta_5 B.size_{it} + \beta_6 SOEs_{it} + \epsilon_{it}$
Model 3	$SGR_{it} = \alpha_i + \beta_1 VAIC_{it} + \beta_2 MCEOs_{it} + \beta_3 VAIC \times MCEOs_{it} + \beta_4 F.Size_{it} + \beta_5 B.Size_{it} + \beta_6 SOEs_{it} + \epsilon_{it}$
Model 4	$SGR_{it} = \alpha_i + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 MCEOs_{it} + \beta_5 CEE \times MCEOs_{it} + \beta_6 HCE \times MCEOs_{it} + \beta_7 SCE \times MCEOs_{it} + \beta_8 F.Size_{it} + \beta_9 B.Size_{it} + \beta_{10} SOEs_{it} + \epsilon_{it}$
Model 5	$SGR_{it} = \alpha_i + \beta_1 VAIC_{it} + \beta_2 SCG_{it} + \beta_3 VAIC \times SCG_{it} + \beta_4 F.Size_{it} + \beta_5 B.Size_{it} + \beta_6 SOEs_{it} + \epsilon_{it}$
Model 6	$SGR_{it} = \alpha_i + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 SCG_{it} + \beta_5 CEE \times SCG_{it} + \beta_6 HCE \times SCG_{it} + \beta_7 SCE \times SCG_{it} + \beta_8 F.Size_{it} + \beta_9 B.Size_{it} + \beta_{10} SOEs_{it} + \epsilon_{it}$
Panel B: Two-Way Fixed Effect	
Model 1	$SGR_{it} = \alpha_i + \gamma_t + \beta_1 VAIC_{it} + \beta_2 F.Size_{it} + \beta_3 B.Size_{it} + \beta_4 SOEs_{it} + \epsilon_{it}$
Model 2	$SGR_{it} = \alpha_i + \gamma_t + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 F.Size_{it} + \beta_5 B.Size_{it} + \beta_6 SOEs_{it} + \epsilon_{it}$
Model 3	$SGR_{it} = \alpha_i + \gamma_t + \beta_1 VAIC_{it} + \beta_2 MCEOs_{it} + \beta_3 VAIC \times MCEOs_{it} + \beta_4 F.Size_{it} + \beta_5 B.Size_{it} + \beta_6 SOEs_{it} + \epsilon_{it}$
Model 4	$SGR_{it} = \alpha_i + \gamma_t + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 MCEOs_{it} + \beta_5 CEE \times MCEOs_{it} + \beta_6 HCE \times MCEOs_{it} + \beta_7 SCE \times MCEOs_{it} + \beta_8 F.Size_{it} + \beta_9 B.Size_{it} + \beta_{10} SOEs_{it} + \epsilon_{it}$
Model 5	$SGR_{it} = \alpha_i + \gamma_t + \beta_1 VAIC_{it} + \beta_2 SCG_{it} + \beta_3 VAIC \times SCG_{it} + \beta_4 F.Size_{it} + \beta_5 B.Size_{it} + \beta_6 SOEs_{it} + \epsilon_{it}$
Model 6	$SGR_{it} = \alpha_i + \gamma_t + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \beta_4 SCG_{it} + \beta_5 CEE \times SCG_{it} + \beta_6 HCE \times SCG_{it} + \beta_7 SCE \times SCG_{it} + \beta_8 F.Size_{it} + \beta_9 B.Size_{it} + \beta_{10} SOEs_{it} + \epsilon_{it}$

Notes: Models (1) and (2) examine the relationship between sustainable growth rate and VAIC and their respective three components. Models (3) and (4) assess MCEO's moderating influence on the relationship between VAIC and its three components with SGR. Models (5) and (6) examine how SCG influences the relationship between VAIC and

its components with SGR. In these models, i represents the firm and t represents the year. The intercept is denoted by α, while the coefficients of the predictor variables are denoted by β_1 through β_{10}. The measurement error term is denoted by ϵ. In the context of panels "A" and "B", the symbol α_i represents the fixed effect for a specific firm, whereas γ_t represents the fixed effect for a specific year. The other variables are identical to those used in the ordinary least squares (OLS) regression.

3.3.4. Simultaneous Quantile Regression

Simultaneous quantile regression is a valuable statistical method when there is a desire to investigate the potential association between a dependent variable and independent variables at various quantiles. This study employs simultaneous quantile regression to examine the influence of IC, MCEOs, and SCG on the SGR at multiple quantiles. We calculate the conditional quantiles of the SGR using Equation (9).

$$Q_{y_{i,t}|x_{i,t}} = \alpha_\tau + x_{i,t}\beta_\tau + \epsilon_{i,t,\tau} \quad (9)$$

where $y_{i,t}$ refers to the SGR, $x_{i,t}$ refers to the VAIC, CEE, HCE, SCE, MCEOs, SCG, VAIC × MCEOs, CEE × MCEOs, HCE × MCEOs, SCE × MCEOs, VAIC × SCG, CEE × SCG, HCE × SCG, SCE × SCG, F.Size, B.Size, and SOEs, and τ represents the conditional quantiles of interest; α_τ and β_τ are quantile-specific interests and coefficient parameters, respectively, and $\epsilon_{i,t,\tau}$ is the error term. The one-way fixed effect model is given by Equation (10).

$$Q_{y_{i,t}|x_{i,t}} = \alpha_\tau + x_{i,t}\beta_\tau + \gamma_i + \epsilon_{i,t,\tau} \quad (10)$$

where γ_i the firm fixed effect which expresses the time-invariant differences in the intercepts across firms. Equation (11) represents the two-way fixed effect.

$$Q_{y_{i,t}|x_{i,t}} = \alpha_\tau + x_{i,t}\beta_\tau + \gamma_i + \delta_t + \epsilon_{i,t,\tau} \quad (11)$$

where δ_t is the time fixed effect, which expresses the time invariant differences in the intercepts across periods.

We used simultaneous regression analysis with a fixed effect to estimate the models [91]. This is because quantile regression results are reliable even when there are outliers in the data [26]. The estimation process considers the potential heterogeneity between enterprises and time periods to produce the SGR's conditional quantiles. The fixed effect model enables us to account for unobserved time-invariant heterogeneity, hence controlling for firm-specific and time-specific effects [91].

4. Empirical Results

4.1. Descriptive Statistics

Table 3 contains descriptive statistics regarding the mean, median, minimum, maximum, and standard deviation. The mean value of the SGR is 0.0966, indicating that Chinese non-financial enterprises possess a comparatively weaker sustainable growth capacity. The positive mean values of the VAIC, CEE, HCE, and SCE imply that, on average, Chinese non-financial enterprises exhibit good IC efficiency. The negative values indicate that the costs associated with having IC exceed its contribution to the firm's creating value process [9].

The average value of MCEOs is 0.0079, indicating that approximately 0.79% of CEOs possess military experience. The average SCG value is 3.4362, indicating that, on average, Chinese non-financial enterprises are enhancing their practices to attain long-term sustainability. The reasonable mean value of control variables suggests that they will mitigate variation during regression analysis.

Table 3. Descriptive Statistics.

Variables	Obs.	Min	Max	Mean	Std. Dv
SGR	9750	−0.5102	2.4599	0.0966	0.1434
VAIC	9750	−64.6503	117.6039	1.3736	10.4423
CEE	9750	−56.6296	1.9150	0.0891	0.8880
HCE	9750	−13.7263	13.51573	1.0959	1.4304
SCE	9750	−64.2029	117.1464	0.1885	10.3665
MCEOs	9750	0	1	0.0079	0.0888
SCG	9750	0	8	3.4362	1.9754
F.Size	9750	17.4848	28.6364	22.0547	1.4667
B.Size	9750	4	32	8.9797	2.6547
SOEs	9750	0	1	0.1315	0.3380

Notes: This table reports descriptive statistics for variables included in the model for non-financial firms traded on the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE), China, from 2010 to 2022. These are the values assigned to variables: sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), military-experienced CEOs (MCEOs), sustainable corporate governance (SCG), firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). Source: Author's Estimations.

4.2. Correlation Analysis

Table 4 displays the correlation analysis between dependent and independent variables. The correlation study indicates a substantial positive association between the SGR and the VAIC, CEE, HCE, MCEOs, and SCG, except for SCE, which does not correlate significantly with the SGR.

Table 4. Correlation Analysis.

Variables	SGR	VAIC	CEE	HCE	SCE	MCEOs	SCG	F.Size	B.Size	SOEs
SGR	1									
VAIC	0.298 ***	1								
CEE	0.074 ***	0.036 ***	1							
HCE	0.365 ***	0.0598 ***	0.123 ***	1						
SCE	0.013	0.998 ***	−0.001	0.009 ***	1					
MCEOs	0.098 ***	0.004 ***	0.007 ***	0.012 **	0.010 ***	1				
SCG	0.362 ***	0.025 ***	−0.015	0.147 ***	−0.017	0.066 ***	1			
F.Size	0.178 ***	0.011 ***	0.052 ***	0.052 *	0.007 ***	0.144 ***	0.443 *	1		
B.Size	0.099 ***	0.024 ***	0.023 ***	0.035 *	−0.002	0.109 ***	0.095 **	0.224 ***	1	
SOEs	0.102 ***	0.010 ***	0.011 ***	0.103 ***	0.015 ***	0.109 ***	0.189 ***	0.443 **	0.192 **	1

Notes: This table shows the correlation matrix among sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), military-experienced CEOs (MCEOs), sustainable corporate governance (SCG), firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). Source: Author's Estimations. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

4.3. Multicollinearity Test

Table 5 presents the variance inflation factor test, which evaluates multicollinearity within the multivariate model for each explanatory variable. If the Variance Inflation Factor (VIF) is equal to 1, there is no association among the explanatory variables; nevertheless, if it exceeds 10, multicollinearity is present [89]. Table 5 indicates the absence of multicollinearity across all explanatory factors. Multicollinearity diminishes the stability and dependability of panel regression models. The lack of multicollinearity enhances the precision of computed coefficients and augments the statistical power of the regression model [93].

Table 5. Multicollinearity Test.

Models		VAIC	CEE	HCE	SCE	MCEOs	SCG	F.Size	B.Size	SOEs	Mean
1	VIF	1						1.28	1.07	1.26	1.15
	1/VIF	0.999						0.782	0.938	0.794	
2	VIF		1.02	1.03	1			1.28	1.07	1.27	1.11
	1/VIF		0.982	0.973	0.999			0.782	0.938	0.788	
3	VIF	1				1.02		1.28	1.07	1.28	1.13
	1/VIF	0.999				0.979		0.783	0.935	0.783	
4	VIF		1.02	1.03	1	1.02		1.28	1.07	1.29	1.10
	1/VIF		0.982	0.974	0.999	0.979		0.781	0.935	0.776	
5	VIF	1					1.25	1.53	1.07	1.26	1.22
	1/VIF	0.999					0.802	0.655	0.938	0.795	
6	VIF		1.02	1.05	1		1.27	1.54	1.07	1.27	1.17
	1/VIF		0.981	0.954	0.999		0.785	0.650	0.938	0.787	

Notes: This table displays the multicollinearity test results for each model outlined in the regression analyses conducted in this paper, with the VIF test data provided above. Source: Author's Estimation.

4.4. Cross-Sectional Dependency Test

Table 6 indicates that the variables employed in this study exhibit no cross-sectional dependency. The Breusch–Pagan LM test statistic is 4583.44, with 4148 degrees of freedom and a probability value of 0. The Pesaran-scaled LM and Pesaran CD test statistics are 9.065 and 4.804, respectively, with a probability value of 0. The results indicate the absence of cross-sectional dependency in the data; hence, they affirm the validity of the regression outcomes derived from the study. The cross-sectional independence ensures that the calculated coefficients are unbiased and that the assessment of standard errors is accurate. It indicates the dependability and accuracy of the conclusions drawn from the regression analysis [91].

Table 6. Cross-sectional dependency test.

Test	Statistics	df	Prob
Breusch–Pagan LM	4583.44	4148	0.0000
Pesaran-scaled LM	9.065		0.0000
Pesaran CD	4.804		0.0000

Notes: The table reports cross-sectional dependency tests among sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), military-experienced CEOs (MCEOs), sustainable corporate governance (SCG), VAIC × MCEOs, CEE × MCEOs, HCE × MCEOs, SCE × MCEOs, VAIC × SCG, CEE × SCG, HCE × SCG, SCE × SCG, Firm Size (F.Size), Board Size (B.Size), and state-owned firms (SOEs). Source: Author's Estimations.

4.5. Panel Unit Root Testing

Table 7 presents first-generation testing, specifically, the IPS and Breitung tests, conducted on the SGR, VAIC, CEE, HCE, SCE, MCEOs, SCG, F.Size, B.Size, and SOEs, as well as second-generation tests, namely the CIPS and CADF tests, applied to the same variables assessed in the first-generation tests. We use the IPS test to determine the stationarity of a time-series or the existence of a unit root. The test findings demonstrate that each variable possesses negative *t*-statistics at the 1% significance level. Consequently, the null hypothesis is rejected. Conversely, the Breitung test assumes that a panel data set contains a unit root. The results show that the negative values at a 1% significance level reject the null hypothesis.

The second-generation unit root tests, CIPS and CADF, address cross-sectional dependence and variability in the panel data. We formulate the CADF test, an extension of the ADF, to address cross-sectional reliance and heterogeneity while the CIPS remains resilient to cross-sectional dependency. The outcomes of CIPS and CADF both reject the null

hypothesis at the 1% significance level. The results of the panel unit root tests demonstrate that all variables are stationary [91].

Table 7. Panel Unit Root Tests.

Test Name	First-Generation		Second-Generation	
Variables	**IPS**	**Breitung**	**CIPS**	**CADF**
SGR	−13.962 ***	−8.086 ***	−4.982 ***	−4.324 ***
VAIC	−3.692 ***	−4.369 ***	−3.897 ***	−4.185 ***
CEE	−3.380 ***	−4.138 ***	−3.421 ***	−4.219 ***
HCE	−4.931 ***	−5.210 ***	−3.182 ***	−4.392 ***
SCE	−3.637 ***	−3.221 ***	−3.112 ***	−3.174 ***
MCEOs	−4.756 ***	−4.453 ***	−4.688 ***	−4.132 ***
SCG	−3.738 ***	−3.609 ***	−4.980 ***	−3.725 ***
F.Size	−5.957 ***	−5.488 ***	−4.156 ***	−3.195 ***
B.Size	−5.514 ***	−6.322 ***	−3.172 ***	−3.216 ***
SOEs	−3.167 ***	−4.115 ***	−4.181 ***	−4.165 ***

Notes: This table presents first-generation and second-generation unit root test for sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), military-experienced CEOs (MCEOs), sustainable corporate governance (SCG), firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance level at 1%. Source: Author's Estimations.

4.6. One-Way Fixed Effect

Table 8 presents the regression results from a one-way fixed effects regression analysis. In Model 1, the VAIC significantly influences the SGR in China. Model 1 indicates that a one percent increase in the VAIC results in a 0.0135% rise in the SGR, as demonstrated in Table 9. The VAIC positively influences the SGR, aligning with the findings of [9,65]. Consequently, the present findings corroborate *H1A*. Model 2 illustrates the influence of the aspects of IC designated as CEE, HCE, and SCE on the SGR. The findings indicate that CEE, HCE, and SCE influence the SGR considerably and favorably, confirming *H1B*, *H1C*, and *H1D*. The coefficients of CEE and HCE exceed those of SCE. The data show that the R-squared value goes up from 0.105 in model 1 to 0.226 in model 2. The overall VAIC measure is not as good as the results from the three separate VAIC measures when explaining the SGR, which is similar to [3,9].

Table 8. One-way Fixed Effect.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VAIC	0.0135 ***		0.0277 ***		0.0443 ***	
	(0.00543)		(0.00845)		(0.0139)	
CEE		0.145 ***		0.0184 ***		0.0280 ***
		(0.0173)		(0.00590)		(0.0110)
HCE		0.302 ***		0.903 ***		0.594 ***
		(0.120)		(0.196)		(0.230)
SCE		0.00598 ***		0.00631 ***		0.00576 ***
		(0.00209)		(0.00205)		(0.00200)
MCEOs			0.0693 ***	0.0314 ***		
			(0.00590)	(0.00666)		
SCG					0.430 ***	0.601 ***
					(0.127)	(0.152)
VAIC*MCEOs			0.434 ***			
			(0.126)			

Table 8. *Cont.*

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VAIC*SCG					0.865 ***	
					(0.272)	
CEE*MCEOs				0.630 ***		
				(0.241)		
HCE*MCEOs				0.452 ***		
				(0.156)		
SCE*MCEOs				0.0273 ***		
				(0.0108)		
CEE*SCG						0.796 ***
						(0.170)
HCE*SCG						0.680 ***
						(0.256)
SCE*SCG						0.702 ***
						(0.249)
F.Size	0.108 ***	0.818 ***	0.123 ***	0.277 ***	0.409 ***	0.482 ***
	(0.0423)	(0.331)	(0.0367)	(0.0347)	(0.142)	(0.198)
B.Size	0.00312 ***	0.00266 ***	0.00279 ***	0.00307 ***	0.00215 **	0.00284 ***
	(0.000953)	(0.000890)	(0.000935)	(0.000872)	(0.000908)	(0.000850)
SOEs	0.312 ***	0.166 ***	0.724 **	0.738 ***	0.192 ***	0.810 **
	(0.117)	(0.0480)	(0.348)	(0.255)	(0.0510)	(0.353)
Constant	0.700 ***	0.749 ***	0.502 ***	0.259 ***	0.735 ***	0.682 ***
	(0.0803)	(0.0793)	(0.0806)	(0.0766)	(0.0913)	(0.0865)
Observations	9750	9750	9750	9750	9750	9750
Firms (groups)	750	750	750	750	750	750
Years	13	13	13	13	13	13
R-squared	0.105	0.226	0.139	0.253	0.190	0.292
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Firms EF	Yes	Yes	Yes	Yes	Yes	Yes
Years EF	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table summarizes the regression results of one-way fixed effect for sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), military-experienced CEOs (MCEOs), sustainable corporate governance (SCG), VAIC*MCEOs, VAIC*SCG, CEE*MCEOs, HCE*MCEOs, SCE*MCEOs, CEE*SCG, HCE*SCG, SCE*SCG, firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance at 1% level, ** Significance at 5% level. Source: Author's Estimations.

Table 9. Two-way Fixed Effect.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VAIC	0.0682 ***		0.0191 ***		0.0380 ***	
	(0.0111)		(0.00709)		(0.0141)	
CEE		0.0884 ***		0.0817 ***		0.0807 ***
		(0.0122)		(0.0221)		(0.0132)
HCE		0.575 ***		0.557 ***		0.503 ***
		(0.143)		(0.171)		(0.204)
SCE		0.00764 ***		0.00846 ***		0.00697 ***
		(0.00221)		(0.00258)		(0.00217)
MCEOs			0.0125 ***	0.0163 ***		
			(0.00471)	(0.00549)		

Table 9. *Cont.*

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SCG					0.751 ***	0.710 ***
					(0.147)	(0.161)
VAIC*MCEOs			0.881 ***			
			(0.322)			
VAIC*SCG					0.883 ***	
					(0.181)	
CEE*MCEOs				0.583 ***		
				(0.159)		
HCE*MCEOs				0.820 ***		
				(0.301)		
SCE*MCEOs				0.129 ***		
				(0.0398)		
CEE*SCG						0.339 ***
						(0.0422)
HCE*SCG						0.592 ***
						(0.150)
SCE*SCG						0.597 ***
						(0.196)
F.Size	0.623 ***	0.441 ***	0.643 ***	0.674 ***	0.0488 ***	0.126
	(0.167)	(0.122)	(0.167)	(0.158)	(0.0174)	(0.165)
B.Size	0.00358 ***	0.00308 ***	0.00371 ***	0.00339 ***	0.00346 ***	0.00340 ***
	(0.000811)	(0.000757)	(0.000812)	(0.000759)	(0.000797)	(0.000744)
SOEs	0.720 ***	0.451 **	0.307 ***	0.597	0.653 **	0.422 ***
	(0.294)	(0.225)	(0.102)	(0.657)	(0.283)	(0.141)
Constant	0.269 ***	0.371 ***	0.278 ***	0.238 ***	0.179 ***	0.147 ***
	(0.0361)	(0.0371)	(0.0362)	(0.0344)	(0.0362)	(0.0352)
Observations	9750	9750	9750	9750	9750	9750
Firms (groups)	750	750	750	750	750	750
Years	13	13	13	13	13	13
R-squared	0.019	0.148	0.021	0.146	0.054	0.177
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000
Firm EF	Yes	Yes	Yes	Yes	Yes	Yes
Years EF	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table indicates the regression results of two-way fixed effect for sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), military-experienced CEOs (MCEOs), sustainable corporate governance (SCG), VAIC*MCEOs, VAIC*SCG, CEE*MCEOs, HCE*MCEOs, SCE*MCEOs, CEE*SCG, HCE*SCG, SCE*SCG, firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance at 1% level, ** Significance at 5% level. Source: Author's Estimations.

Model 3 demonstrates that the interaction term (VAIC*MCEOs) exerts a significant and favorable effect on the SGR. The VAIC coefficient went from 0.0277 (without moderation) to 0.434 (with the moderation of MCEOs), which shows that the interaction term (VAIC*MCEOs) makes the SGR stronger in China. Consequently, *H2A* is supported. Model 4 illustrates the moderating effect of MCEOs on components of IC, with the findings indicating that the interaction terms (CEE*MCEOs, HCE*MCEOs, SCE*MCEOs) demonstrate a significant and beneficial impact on the SGR. The coefficients of CEE, HCE, and SCE increase with the moderation of MCEOs compared to the coefficients without moderation. The R-squared value of model 4 exceeds that of model 3, and the findings supported *H2B*, *H2C*, and *H2D*.

Model 5 demonstrates that the moderating effect of SCG has impacted the relationship between IC and the SGR in Chinese firms. The coefficient value of 0.0443 for the VAIC (without moderation) is inferior to the coefficient value of 0.865 for the VAIC (with the moderation of SCG), indicating that the inclusion of SCG enhances the relationship between IC and the SGR. Consequently, *H3A* has been confirmed. Model 6 shows that interaction terms (CEE*SCG, HCE*SCG, SCE*SCG) significantly and positively influence the SGR. The greater coefficient value of interaction terms (CEE*SCG, HCE*SCG, SCE*SCG) than CEE, HCE, and SCE implies that SCG's presence has made IC components impactful for the SGR. The R-squared value increases from 0.190 in model 5 to 0.292 in model 6. The results supported *H3B*, *H3C*, and *H3D.*

4.7. Two-Way Fixed Effect

Table 9 presents the regression results from a one-way fixed effects regression analysis. In model 1, the coefficient value of 0.0682 for the VAIC is considerably positive, suggesting that Chinese firms with a better IC performance exhibit higher sustainable growth rates. This outcome confirms *H1A* and is identical to [9,61]. Model 2 indicates that CEE, HCE, and SCE possess positive and significant coefficient values. The HCE coefficient value of 0.575, which exceeds that of CEE and SCE, indicates that HCE is an essential element of IC for enhancing the SGR. The R-squared value of model 2 exceeds that of model 1, which adheres to a one-way fixed effect. The outcomes of model 2 validate *H1B*, *H1C*, and *H1D* and are similar to [9].

Model 3 indicates that the interaction term (VAIC*MCEOs) significantly and favorably correlates with a coefficient of 0.881, which surpasses the coefficient of 0.0191 for the VAIC, suggesting that MCEOs with leadership qualities and management capabilities positively influence the SGR. Consequently, this result confirms *H2A.* Model 4 indicates that the coefficient values of the three components of IC, when moderated by MCEOs, are greater than those without moderation under one-way fixed effects. The superior R-squared value of model 4 compared to model 3 indicates that the three VAIC measures with moderators more effectively elucidate the SGR than the aggregate VAIC measure with a moderator. Consequently, the results support *H2B*, *H2C*, and *H2D.*

Model 5 indicates that the coefficient value of 0.883 for VAIC*SCG positively and significantly enhances the relationship between IC and the SGR. The higher coefficient value of the interaction term (VAIC*SCG) compared to the VAIC signifies that SCG is crucial for the SGR. Model 6 indicates that the coefficient values of the interaction terms (CEE*SCG, HCE*SCG, SCE*SCG) exert a significant and favorable effect on the SGR. The R-squared value of model 6 exceeds that of model 5, according to the one-way fixed effect criterion.

4.8. Quantile Regression Analysis

Table 10 presents the coefficient values for each variable over many quantiles (0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, and 0.90), accompanied by the standard error values in the parenthesis. This table indicates that in the 10th, 20th, and 30th quantiles, the VAIC does not significantly affect the SGR. At the 90th percentile, it exhibits the highest coefficient value of 0.0646, which favorably and considerably affects the SGR following [3,9]. Our data indicate that the VAIC has a favorable and considerable impact on the SGR, aligning with other economic theories. Consequently, these results confirm *H1A* and are similar to those findings mentioned in one-way and two-way fixed effects.

Table 10. Nexus between IC and SGR.

Variables	Quantiles								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
VAIC	0.0237	0.0298	0.0395	0.0442 *	0.0473 **	0.0512 ***	0.0558 ***	0.0592 ***	0.0646 ***
	(0.0315)	(0.0278)	(0.0254)	(0.0241)	(0.0223)	(0.0203)	(0.0176)	(0.0154)	(0.0138)
F.Size	0.430 ***	0.506 ***	0.642 ***	0.687 ***	0.712 ***	0.743 ***	0.768 ***	0.809 ***	0.825 ***
	(0.170)	(0.151)	(0.149)	(0.135)	(0.122)	(0.119)	(0.0988)	(0.0859)	(0.0834)
B.Size	0.000741	0.00138	0.00189	0.00237 **	0.00267 ***	0.00285 ***	0.00335 ***	0.00348 ***	0.00390 ***
	(0.00330)	(0.00143)	(0.00123)	(0.00104)	(0.000998)	(0.000843)	(0.000821)	(0.000711)	(0.000659)
SOEs	0.266	0.492	0.682	0.699	0.735	0.778	0.831 **	0.889 ***	0.927 ***
	(0.618)	(0.597)	(0.564)	(0.515)	(0.484)	(0.442)	(0.382)	(0.325)	(0.286)
Cons	0.189 ***	0.172 ***	0.198 ***	0.221 **	0.152	0.287 ***	0.234 ***	0.115	0.178 ***
	(0.0612)	(0.0589)	(0.0811)	(0.0978)	(0.106)	(0.117)	(0.0892)	(0.136)	(0.0654)
Ps. R2	0.129	0.145	0.172	0.198	0.221	0.253	0.264	0.278	0.312

Notes: This table presents the quantile regression results for sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance at 1% level, ** Significance at 5% level, and * Significance at 10% level. Source: Author's Estimations.

Table 11 demonstrates that CEE and HCE have a positive and significant correlation with the SGR at the 80th and 90th quantiles, with the greatest coefficient values observed at the 90th quantile. The results indicate that HCE has a stronger effect on the SGR, corresponding with the findings of [35,94]. SCE exerts a favorable and considerable influence at the 10th, 20th, and 30th quantiles. The findings of this investigation are consistent with those of a prior study [9,65,70,71]. The findings validate *H1B*, *H1C*, and *H1D* and are consistent with the conclusions obtained from one-way and two-way fixed effects. F.Size, B.Size, and SOEs demonstrate a substantial positive and significant impact at the 90th quantile.

Table 11. Nexus between components of IC and SGR.

Variables	Quantiles								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
CEE	0.0214	0.0206	0.0191	0.0172	0.0169	0.0147 *	0.0143 **	0.0138 ***	0.0131 ***
	(0.0198)	(0.0157)	(0.0135)	(0.0111)	(0.0101)	(0.00810)	(0.00611)	(0.00421)	(0.00376)
HCE	0.278	0.459 ***	0.502 ***	0.589 ***	0.653 ***	0.727 ***	0.775 ***	0.813 ***	0.907 ***
	(0.201)	(0.185)	(0.154)	(0.148)	(0.133)	(0.117)	(0.108)	(0.0983)	(0.0884)
SCE	0.00593 ***	0.00529 ***	0.00455 ***	0.00327	0.00258	0.00174	0.00132	0.000931	0.000656
	(0.00131)	(0.00158)	(0.00173)	(0.00199)	(0.00213)	(0.00224)	(0.00245)	(0.00353)	(0.00458)
F.Size	0.518	0.589	0.642	0.677 **	0.713 ***	0.754 ***	0.794 ***	0.838 ***	0.899 ***
	(0.498)	(0.412)	(0.365)	(0.321)	(0.275)	(0.233)	(0.201)	(0.165)	(0.127)
B.Size	−0.00186 ***	0.000480	0.000674 **	0.000873 ***	0.000997 ***	0.00126 ***	0.00185 ***	0.00194 ***	0.00216 ***
	(0.000636)	(0.000487)	(0.000321)	(0.000278)	(0.000214)	(0.000176)	(0.000135)	(0.000114)	(0.0000987)
SOEs	0.642	0.668	0.698	0.736 **	0.769 **	0.799 ***	0.834 ***	0.879 ***	0.932 ***
	(0.423)	(0.401)	(0.389)	(0.354)	(0.326)	(0.302)	(0.281)	(0.245)	(0.218)
Cons	0.139 ***	0.217	0.0917 ***	0.146	0.153	0.199	0.224 ***	0.216 ***	0.317 ***
	(0.0423)	(0.154)	(0.0356)	(0.125)	(0.178)	(0.159)	(0.0887)	(0.0656)	(0.115)
Ps. R2	0.0178	0.0923	0.187	0.196	0.228	0.235	0.284	0.301	0.352

Notes: This table analyzes the quantile regression results for sustainable growth rate (SGR), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance at 1% level, ** Significance at 5% level, and * Significance at 10% level. Source: Author's Estimations.

Table 12 indicates that the VAIC has a significant and favorable effect on the SGR, with a coefficient value 0.0599 at the 90th quantile. However, this impact increases to a coefficient value of 0.935 at the 90th quantile with the moderation of MCEOs. The model outcomes

correspond with other theories and further validate *H2A*, as indicated by the one-way and two-way fixed effects. The control variables F.Size, B.Size, and SOEs significantly influence various quantiles.

Table 12. Nexus between IC and SGR with the moderation of MCEOs.

Variables	Quantiles								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
VAIC	0.00574	0.0115	0.0153	0.0195 ***	0.0253	0.0318	0.0388 ***	0.0472 ***	0.0599 ***
	(0.0198)	(0.0167)	(0.0146)	(0.00653)	(0.0224)	(0.0254)	(0.0143)	(0.0132)	(0.0164)
MCEOs	0.0331 ***	0.0427	0.0490 **	0.0559	0.0653 ***	0.0761 ***	0.0786 ***	0.101	0.122 ***
	(0.0126)	(0.0279)	(0.0228)	(0.0432)	(0.0221)	(0.0265)	(0.0234)	(0.0987)	(0.0221)
VAIC*MCEOs	0.535 ***	0.609 ***	0.649	0.687	0.737	0.779 ***	0.843 ***	0.892 ***	0.935 ***
	(0.212)	(0.236)	(0.459)	(0.428)	(0.473)	(0.176)	(0.223)	(0.267)	(0.275)
F.Size	0.496 *	0.569 **	0.613 ***	0.662	0.697	0.751	0.802	0.869	0.919 ***
	(0.266)	(0.275)	(0.233)	(0.397)	(0.472)	(0.598)	(0.554)	(0.492)	(0.301)
B.Size	0.000814 ***	0.00133 ***	0.00167 ***	0.00205 ***	0.00256	0.00315	0.00378	0.00453	0.00567
	(0.000237)	(0.000459)	(0.000519)	(0.000728)	(0.00469)	(0.00619)	(0.00351)	(0.00393)	(0.00421)
SOEs	0.220	0.275 ***	0.358 ***	0.426	0.498	0.564 **	0.603 ***	0.651 ***	0.728 ***
	(0.198)	(0.103)	(0.138)	(0.337)	(0.384)	(0.267)	(0.224)	(0.215)	(0.193)
Cons	0.521 ***	0.476 ***	0.511 ***	0.694 **	0.273	0.118 ***	0.563 ***	0.625 ***	0.195 ***
	(0.213)	(0.158)	(0.117)	(0.354)	(0.269)	(0.0315)	(0.193)	(0.149)	(0.0672)
Ps. R2	0.117	0.195	0.228	0.198	0.267	0.283	0.302	0.314	0.331

Notes: This table reports quantile regression results for sustainable growth rate (SGR), value-added intellectual coefficient (VAIC), military-experienced CEOs (MCEOs), VAIC*MCEOs, firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance at 1% level, ** Significance at 5% level, and * Significance at 10% level. Source: Author's Estimations.

In Table 13, the coefficient values for CEE, HCE, and SCE are positive and statistically significant across various quantiles. CEE and HCE have higher coefficient values at the 90th quantile, whereas SCE demonstrates this at the 10th quantile. It was found that the coefficient values of 0.755 and 0.793 for CEE and HCE, when they are moderated, are higher than the coefficient values of 0.0426 and 0.655 for CEE and HCE when they are not moderated at the 90th quantile. Conversely, the coefficient value of SCE with moderation is greater yet non-significant compared to SCE without moderation at the 10th quantile. However, SCE with moderation exerts a positive and substantial influence at the 20th quantile, with a coefficient value of 0.0404. These findings substantiate our assertion that the presence of ethical CEOs on the board who exhibit devotion and commitment to their enterprises might facilitate superior decision making rather than the pursuit of personal interests [22,95]. The findings further validate the robustness of *H2B*, *H2C*, and *H2D*, as indicated by the one-way and two-way fixed effects. The control factors likewise exhibit a positive and significant impact on the SGR across various quantiles.

Table 13. Nexus between components of IC and SGR with the moderation of MCEOs.

Variables	Quantiles								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
CEE	0.00172 ***	0.00589 ***	0.00895 ***	0.0125	0.0156	0.0216	0.0268	0.0325 ***	0.0426 ***
	(0.000621)	(0.00115)	(0.00274)	(0.00799)	(0.00989)	(0.0165)	(0.0305)	(0.0115)	(0.0149)
HCE	0.0611 *	0.118	0.195	0.262 ***	0.305	0.383 ***	0.492 ***	0.584 ***	0.655 ***
	(0.0329)	(0.103)	(0.166)	(0.0954)	(0.271)	(0.139)	(0.158)	(0.204)	(0.236)
SCE	0.00799 ***	0.00757	0.00726	0.00690	0.00645	0.00597	0.00545**	0.00487 ***	0.00385 ***
	(0.00329)	(0.0342)	(0.0449)	(0.00589)	(0.00582)	(0.00601)	(0.00239)	(0.00175)	(0.00104)
MCEOs	0.00365	0.0105 **	0.0156 ***	0.0216	0.0289 ***	0.0368 ***	0.0454 ***	0.0549 ***	0.0717 ***
	(0.00269)	(0.00459)	(0.00553)	(0.0198)	(0.00933)	(0.0117)	(0.0139)	(0.0193)	(0.0259)

Table 13. *Cont.*

Variables	Quantiles								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
CEE*MCEOs	0.182	0.195	0.273	0.351 ***	0.402 ***	0.499	0.561 ***	0.662 ***	0.755 ***
	(0.179)	(0.268)	(0.259)	(0.131)	(0.119)	(0.351)	(0.221)	(0.237)	(0.262)
HCE*MCEOs	0.119 ***	0.172	0.229 ***	0.263	0.358 **	0.416 ***	0.562 ***	0.687	0.793 ***
	(0.0337)	(0.161)	(0.0755)	(0.238)	(0.159)	(0.129)	(0.105)	(0.553)	(0.208)
SCE*MCEOs	0.0519	0.0404 ***	0.0339	0.0280	0.0225 ***	0.0174	0.0138	0.0109 ***	0.00875 ***
	(0.0698)	(0.0129)	(0.0335)	(0.0250)	(0.00735)	(0.0889)	(0.0129)	(0.00336)	(0.00227)
F.Size	0.0672 ***	0.0933 ***	0.119	0.145 ***	0.175	0.215 *	0.263	0.303 ***	0.362
	(0.0268)	(0.0299)	(0.0995)	(0.0428)	(0.193)	(0.115)	(0.239)	(0.104)	(0.273)
B.Size	0.000951 ***	0.00148	0.00187	0.00232 ***	0.00288 ***	0.00349 ***	0.00414	0.00486	0.00614 ***
	(0.000338)	(0.000984)	(0.00133)	(0.000881)	(0.00112)	(0.00131)	(0.00378)	(0.00403)	(0.00244)
SOEs	0.191	0.288	0.342	0.419	0.492 ***	0.553 ***	0.619 ***	0.717 ***	0.774 ***
	(0.154)	(0.239)	(0.392)	(0.355)	(0.172)	(0.211)	(0.244)	(0.259)	(0.206)
Cons	0.0951 ***	0.114 ***	0.131	0.153 ***	0.172 ***	0.201 **	0.248 ***	0.271 ***	0.303 ***
	(0.0327)	(0.0228)	(0.0799)	(0.0624)	(0.0592)	(0.0998)	(0.0873)	(0.0921)	(0.107)
Ps. R2	0.0583	0.0939	0.132	0.151	0.263	0.216	0.193	0.239	0.296

Notes: This table explains the quantile regression results for sustainable growth rate (SGR), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), CEE*MCEOs, HCE*MCEOs, SCE*MCEOs, firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance at 1% level, ** Significance at 5% level, and * Significance at 10% level. Source: Author's Estimations.

Table 14 discusses that the moderation of SCG enhances the efficacy of the VAIC. The coefficient value of 0.0468 for the VAIC is less than the coefficient value of 0.863 for the interaction term (VAIC*SCG) at the 90th quantile, indicating the significance of SCG's presence within firms. The coefficient value of the interaction term (VAIC*SCG) at the 90th quantile indicates that a 1-unit rise in VAIC*SCG corresponds to a 0.863% increase in the SGR, much surpassing the coefficient value of the VAIC, which is linked with just a 0.0468% increase in the SGR. Therefore, *H3A* is supported by these findings, consistent with the conclusions obtained from one-way and two-way fixed effects. F.Size, B.Size, and SOEs positively and considerably affect the SGR across several quantiles, with a pronounced influence at the 90th quantile.

Table 14. Nexus between IC and SGR with the moderation of SCG.

Variables	Quantiles								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
VAIC	0.0407 ***	0.0420	0.0428 ***	0.0437	0.0444	0.0451	0.0456	0.0460 ***	0.0468 ***
	(0.0113)	(0.0303)	(0.00997)	(0.0338)	(0.0375)	(0.0411)	(0.0428)	(0.0151)	(0.0162)
SCG	0.158 ***	0.183 ***	0.199	0.239	0.291	0.332	0.374 **	0.415 ***	0.462 ***
	(0.0558)	(0.0619)	(0.159)	(0.206)	(0.229)	(0.295)	(0.184)	(0.139)	(0.128)
VAIC*SCG	0.443	0.495	0.553	0.604	0.651	0.722 ***	0.764 ***	0.827 ***	0.863 ***
	(0.417)	(0.428)	(0.443)	(0.451)	(0.439)	(0.291)	(0.263)	(0.255)	(0.259)
F.Size	0.115 ***	0.143	0.174 ***	0.228	0.253	0.294	0.317	0.348	0.377 ***
	(0.0335)	(0.0964)	(0.0661)	(0.163)	(0.298)	(0.251)	(0.329)	(0.331)	(0.141)
B.Size	0.000449 ***	0.000931 ***	0.00121	0.00156	0.00201	0.00253	0.00312	0.00364	0.00454 ***
	(0.000154)	(0.000253)	(0.000997)	(0.00192)	(0.00195)	(0.00217)	(0.00251)	(0.00339)	(0.00151)
SOEs	0.0765	0.0931	0.129	0.154	0.172	0.196 ***	0.239 ***	0.271 *	0.305 ***
	(0.0592)	(0.0739)	(0.0892)	(0.129)	(0.193)	(0.0771)	(0.0822)	(0.148)	(0.105)
Cons	0.165 ***	0.211	0.185 **	0.382	0.592	0.204	0.661 ***	0.773 ***	0.711 ***
	(0.0439)	(0.193)	(0.0914)	(0.279)	(0.427)	(0.138)	(0.132)	(0.175)	(0.219)
Ps. R2	0.126	0.136	0.159	0.188	0.216	0.236	0.261	0.289	0.316

Notes: This table displays the quantile regression results for growth rate (SGR), value-added intellectual coefficient (VAIC), VAIC*SCG, firm size (F.Size), board size (B.Size), and state-owned firms (SOEs). *** Significance at 1% level, ** Significance at 5% level, and * Significance at 10% level. Source: Author's Estimations.

The findings in Table 15 indicate that SCG enhances the connection between IC and the SGR. CEE and HCE, in the absence of moderation, exert a positive and significant influence on the SGR, with coefficient values of 0.0533 and 0.552, respectively. This influence is less pronounced than the coefficient values of 0.529 and 0.559 for CEE and HCE with moderation at the 90th quantile. The coefficient value of SCE with moderation is 0.671, surpassing the coefficient value of 0.00603 for SCE without moderation at the 10th quantile. These findings indicate that SCG is crucial for firms, as SCG fosters long-term benefits above short-term advantages, promoting sustainability. The results also validate *H3B*, *H3C*, and *H3D*, consistent with the conclusions obtained from one-way and two-way fixed effects. The control variables F.Size, B.Size, and SOEs positively and significantly influence the SGR across various quantiles.

Table 15. Nexus between components of IC and SGR with the moderation of SCG.

Variables	Quantiles								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
CEE	0.0125 ***	0.0139	0.0159 ***	0.0190	0.0225 **	0.0271	0.0381	0.0461	0.0533 ***
	(0.00349)	(0.0128)	(0.0582	(0.0121)	(0.0109)	(0.0173)	(0.0331)	(0.0318)	(0.0215)
HCE	0.108 ***	0.153 ***	0.199 *	0.256	0.318	0.371 *	0.443	0.518 ***	0.552 ***
	(0.0339)	(0.0552)	(0.108)	(0.153)	(0.258)	(0.198)	(0.319)	(0.187)	(0.172)
SCE	0.00603 ***	0.00539 ***	0.00458 ***	0.00411	0.00359	0.00304	0.00258	0.00193	0.00128
	(0.00182)	(0.00173)	(0.00159)	(0.00286)	(0.00299)	(0.00258)	(0.00219)	(0.00138)	(0.00116)
SCG	0.225 ***	0.286	0.339	0.381 **	0.437	0.492	0.551	0.604	0.672 ***
	(0.0769)	(0.183)	(0.227)	(0.174)	(0.285)	(0.358)	(0.398)	(0.509)	(0.201)
CEE*SCG	0.0916	0.148 ***	0.173	0.237	0.265	0.319	0.351	0.404 ***	0.529 ***
	(0.0693)	(0.0476)	(0.151)	(0.209)	(0.311)	(0.303)	(0.258)	(0.150)	(0.148)
HCE*SCG	0.218 ***	0.254	0.281	0.338	0.361 ***	0.402	0.459	0.481	0.559 **
	(0.0679)	(0.153)	(0.199)	(0.419)	(0.138)	(0.339)	(0.393)	(0.418)	(0.221)
SCE*SCG	0.671 ***	0.638 ***	0.559	0.488	0.419	0.371	0.339	0.284	0.181
	(0.226)	(0.251)	(0.428)	(0.451)	(0.328)	(0.338)	(0.418)	(0.449)	(0.273)
F.Size	0.0814	0.109	0.141	0.173	0.219	0.247	0.292 ***	0.388	0.449 ***
	(0.0662)	(0.0759)	(0.117)	(0.152)	(0.199)	(0.186)	(0.0993)	(0.397)	(0.142)
B.Size	0.000918 ***	0.00127	0.00158	0.00193	0.00239	0.00271	0.00301	0.00331 **	0.00372
	(0.000228)	(0.000987)	(0.00108)	(0.00152)	(0.00211)	(0.00303)	(0.00297)	(0.00129)	(0.00333)
SOEs	0.129	0.179	0.218	0.269	0.291	0.338	0.407	0.482 ***	0.553 ***
	(0.119)	(0.142)	(0.193)	(0.218)	(0.227)	(0.316)	(0.392)	(0.149)	(0.218)
Cons	0.139 ***	0.118 ***	0.229	0.173	0.339	0.228	0.429	0.448 ***	0.476 ***
	(0.0414)	(0.0331)	(0.206)	(0.238)	(0.299)	(0.217)	(0.416)	(0.159)	(0.126)
Ps. R2	0.119	0.127	0.141	0.166	0.170	0.179	0.184	0.199	0.218

Notes: This table reveals the quantile regression results for sustainable growth rate (SGR), capital employed efficiency coefficient (CEE), human capital efficiency coefficient (HCE), structural capital efficiency coefficient (SCE), sustainable corporate governance (SCG), CEE*SCG, HCE*SCG, SCE*SCG, firm size (F.Size), board size (B.Size), and state-owned firms(SOEs). *** Significance at 1% level, ** Significance at 5% level, and * Significance at 10% level. Source: Author's Estimations.

4.9. Controlling of Confounding Factors

COVID-19 triggered the largest economic crisis across the global economy. The pandemic caused a significant economic downturn and a decline in GDP. Sectors like tourism, hospitality, and retail were particularly affected. Consequently, societies face economic instability, health risks, and reduced resource access, widening the gap between socio-economic groups [23,96–98]. In response to the epidemic, the Central Bank enforced massive monetary expansion through quantitative easing and interest rate reduction for financial market and economic stability [99,100]. Moreover, the central bank used the purchase asset program to inject liquidity into the financial system [100].

Cortes [101] emphasized the critical role of monetary expansions in mitigating extreme financial risks through the tail risk channel. These expansions fostered greater investor

confidence and stabilized capital markets by improving market liquidity and reducing the likelihood of extreme adverse financial events. This stabilization enabled firms to sustain investments and operational activities despite economic turbulence. Furthermore, coordinated monetary policies were particularly effective, minimizing potential distortions in equity and foreign exchange markets caused by uncoordinated capital flows. In short, Cortes's study explains that monetary expansions possibly reduce the tail risk of domestic and international markets and improve SG.

The enhanced stability resulting from these monetary interventions also facilitated growth in Environmental, Social, and Governance (ESG) investments, particularly in critical areas such as healthcare and sustainable infrastructure [102]. By promoting ESG-aligned activities, monetary expansions encouraged firms to allocate resources toward training, technological advancements, and employee development key intellectual capital (IC) elements. Additionally, ESG-driven initiatives fostered innovation, sustainable problem-solving, and collaboration, enhancing knowledge sharing and strengthening IC [99].

However, during COVID-19, firms had to confront the difficulty of sustaining SG due to the economic instability of the epidemic. The companies encountered challenges in adopting and sustaining productivity due to the abrupt transition to remote employment. This study indicates that COVID-19 adversely affected the SGR [103]. Thus, ESG funds should support companies emphasizing social welfare, human rights, and labor norms. Furthermore, ESG funds should facilitate firms adopting socially and environmentally sustainable practices. It compels firms to sustain sustainability [104]. This study demonstrates the beneficial impact of the SGR. The results from Table 16 indicate that including the COVID-19 variable has no effect; nevertheless, ESG funds further increase the outcomes, and the results remain robust after controlling for confounding variables. We only include the primary variables to ensure brevity and conserve space; detailed descriptions are available in the online Supplementary Materials File.

Table 16. Robustness Checks.

Control the Effect of Confounding Factors as ESG Funds and COVID-19									
Variables	**Quantiles**								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
Model 1									
VAIC	0.0230	0.0248	0.0492	0.0541	0.0573	0.061 ***	0.065 ***	0.0692 ***	0.0746 ***
	(0.0311)	(0.0262)	(0.0281)	(0.0318)	(0.0443)	(0.0211)	(0.0196)	(0.0141)	(0.0135)
ESG. F	0.91 ***	0.881	0.731	0.748	0.705	0.781	0.823	0.609	0.961 ***
	(0.351)	(0.592)	(0.791)	(0.682)	(0.889)	(0.718)	(0.813)	(0.692)	(0.318)
COVID-19	−0.291	−0.318	−0.339 ***	−0.428	−0.479	−0.513	−0.522 ***	−0.563	−0.591 ***
	(0.227)	(0.338)	(0.129)	(0.351)	(0.398)	(0.502)	(0.157	(0.529)	(0.219)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ps. R2	0.127	0.151	0.180	0.188	0.201	0.255	0.266	0.270	0.332
Model 2									
CEE	0.0215	0.0210	0.0191	0.0181	0.0165	0.0122	0.0121 **	0.0118 ***	0.0109 ***
	(0.0187)	(0.0167)	(0.0132)	(0.0119)	(0.0110)	(0.00910)	(0.00411)	(0.00320)	(0.00312)
HCE	0.277	0.469 ***	0.520 ***	0.583 ***	0.656 ***	0.731 ***	0.759 ***	0.812 ***	0.909 ***
	(0.225)	(0.181)	(0.151)	(0.145)	(0.131)	(0.114)	(0.103)	(0.0980)	(0.0881)
SCE	0.0059 ***	0.0052 ***	0.0043 ***	0.00325	0.00254	0.00177	0.00131	0.000939	0.000659
	(0.00130)	(0.00153)	(0.00169)	(0.00209)	(0.00223)	(0.00244)	(0.00245)	(0.00361)	(0.00469)
ESG. F	0.821 *	0.932	0.619	0.419 ***	0.338	0.752	0.733	0.973	0.978 ***
	(0.452)	(0.859)	(0.692)	(0.128)	(0.309)	(0.722)	(0.788)	(0.793)	(0.256)
COVID-19	−0.269 ***	−0.293 ***	−0.339	−0.381	−0.447	−0.491	−0.532	−0.559	−0.638 ***
	(0.811)	(0.981)	(0.209)	(0.338)	(0.409)	(0.521)	(0.437)	(0.428)	(0.208)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ps. R2	0.0168	0.0922	0.181	0.121	0.261	0.219	0.261	0.352	0.369

Table 16. *Cont.*

Control the Effect of Confounding Factors as ESG Funds and COVID-19									
Variables	**Quantiles**								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
Model 3									
VAIC	0.00588	0.0112	0.0152	0.020 ***	0.0255	0.0319	0.038 ***	0.0479 ***	0.0598 ***
	(0.0178)	(0.0161)	(0.0149)	(0.0065)	(0.0228)	(0.0256)	(0.0123)	(0.0130)	(0.0162)
MCEOs	0.0342 ***	0.0425	0.0493 **	0.0556	0.065 ***	0.076 ***	0.078 ***	0.108	0.129 ***
	(0.0123)	(0.0299)	(0.0229)	(0.0438)	(0.0209)	(0.0260)	(0.0224)	(0.0981)	(0.0220)
VAIC*MCEOs	0.537 ***	0.612 ***	0.648	0.689	0.738	0.778 ***	0.847 ***	0.889 ***	0.931 ***
	(0.211)	(0.234)	(0.453)	(0.423)	(0.476)	(0.173)	(0.220)	(0.257)	(0.272)
ESG. F	0.229	0.538	0.634	0.991	0.821	0.629	0.553	0.382 **	0.292 ***
	(0.201)	(0.503)	(0.521)	(0.831)	(0.809)	(0.429)	(0.441)	(0.187)	(0.0921)
COVID-19	−0.173 *	−0.292	−0.198	−0.229	−0.379	−0.419	−0.388	−0.491	−0.293 ***
	(0.0921)	(0.218)	(0.207)	(0.239)	(0.309)	(0.408)	(0.521)	(0.408)	(0.109)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ps. R2	0.116	0.199	0.238	0.191	0.263	0.280	0.312	0.214	0.391
Model 4									
CEE	0.00178 ***	0.00583 ***	0.00899 ***	0.0121	0.0152	0.0227	0.0261	0.0329 ***	0.0427 ***
	(0.000622)	(0.00111)	(0.00271)	(0.00798)	(0.00989)	(0.0195)	(0.0305)	(0.0113)	(0.0142)
HCE	0.0610	0.119	0.196	0.266 ***	0.301	0.388 ***	0.493 ***	0.588 ***	0.656 ***
	(0.0529)	(0.123)	(0.176)	(0.0951)	(0.278)	(0.132)	(0.154)	(0.202)	(0.234)
SCE	0.00899 ***	0.00752	0.00724	0.00693	0.00646	0.00598	0.00546 **	0.00489 ***	0.00387 ***
	(0.00319)	(0.0345)	(0.0458)	(0.00599)	(0.00592)	(0.00621)	(0.00239)	(0.00174)	(0.00102)
MCEOs	0.00366	0.0108 **	0.0159 ***	0.0214	0.0292 ***	0.0378 ***	0.0456 ***	0.0550 ***	0.0719 ***
	(0.00279)	(0.00459)	(0.00551)	(0.0199)	(0.00931)	(0.0115)	(0.0138)	(0.0191)	(0.0255)
CEE*MCEOs	0.181	0.194	0.271	0.353 ***	0.404 ***	0.495	0.566 ***	0.665 ***	0.775 ***
	(0.178)	(0.269)	(0.269)	(0.130)	(0.120)	(0.361)	(0.221)	(0.217)	(0.262)
HCE*MCEOs	0.112 ***	0.171	0.230 ***	0.264	0.358	0.417 ***	0.561 ***	0.685	0.799 ***
	(0.0327)	(0.171)	(0.0756)	(0.239)	(0.259)	(0.129)	(0.103)	(0.556)	(0.201)
SCE*MCEOs	0.0518	0.0406 ***	0.0336	0.0285	0.0225 ***	0.0176	0.0130	0.0110 ***	0.00878 ***
	(0.0699)	(0.0129)	(0.0339)	(0.0252)	(0.00721)	(0.0899)	(0.0139)	(0.00332)	(0.00217)
ESG. F	0.723	0.691	0.662	0.639	0.601	0.592	0.551	0.519	0.429 ***
	(0.609)	(0.669)	(0.641)	(0.519)	(0.558)	(0.509)	(0.458)	(0.409)	(0.151)
COVID-19	−0.159	−0.181	−0.229	−0.308	−0.359	−0.387 ***	−0.419	−0.453	−0.558
	(0.119)	(0.258	(0.191)	(0.229)	(0.301)	(0.131)	(0.299)	(0.374)	(0.461)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ps. R2	0.0522	0.0738	0.134	0.155	0.269	0.228	0.195	0.240	0.298
Model 5									
VAIC	0.0428 ***	0.0418	0.0438 ***	0.0432	0.0441	0.0450	0.0451	0.0465 ***	0.0469 ***
	(0.0119)	(0.0301)	(0.00996)	(0.0339)	(0.0379)	(0.0418)	(0.0429)	(0.0150)	(0.0160)
SCG	0.159 ***	0.189 ***	0.213	0.238	0.291	0.330	0.284	0.419***	0.468 ***
	(0.0553)	(0.0614)	(0.159)	(0.209)	(0.259)	(0.296)	(0.254)	(0.132)	(0.121)
VAIC*SCG	0.441	0.491	0.550	0.602	0.650	0.732 ***	0.770 ***	0.829 ***	0.865 ***
	(0.417)	(0.488)	(0.449)	(0.455)	(0.438)	(0.291)	(0.269)	(0.252)	(0.259)
ESG. F	0.918	0.933 **	0.289	0.381	0.294	0.638	0.531	0.722	0.779 ***
	(0.843)	(0.429)	(0.239)	(0.388)	(0.372)	(0.601)	(0.559)	(0.702)	(0.208)
COVID-19	−0.138	−0.173	−0.179	−0.209	−0.288	−0.274	−0.395	−0.419	−0.441 ***
	(0.119)	(0.152)	(0.181)	(0.273)	(0.339)	(0.285)	(0.458)	(0.449)	(0.131)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ps. R2	0.134	0.158	0.129	0.199	0.222	0.235	0.262	0.280	0.356

Table 16. *Cont.*

Control the Effect of Confounding Factors as ESG Funds and COVID-19									
Variables	**Quantiles**								
	0.10	**0.20**	**0.30**	**0.40**	**0.50**	**0.60**	**0.70**	**0.80**	**0.90**
	Model 6								
CEE	0.0128 ***	0.0135	0.0169 ***	0.0199	0.0226 **	0.0279	0.0380	0.0468	0.0583 ***
	(0.00339)	(0.0139)	(0.0580	(0.0122)	(0.0108)	(0.0193)	(0.0335)	(0.0358)	(0.0205)
HCE	0.128 ***	0.153 ***	0.194	0.258	0.313	0.371	0.440	0.518	0.562 ***
	(0.0331)	(0.0551)	(0.138)	(0.156)	(0.259)	(0.288)	(0.369)	(0.587)	(0.172)
SCE	0.00633 ***	0.00538 ***	0.00459 ***	0.00416	0.00354	0.00303	0.00256	0.00190	0.00128
	(0.00182)	(0.00170)	(0.00109)	(0.00286)	(0.00299)	(0.00292)	(0.00259)	(0.00136)	(0.00117)
SCG	0.227 ***	0.285	0.427	0.386 **	0.437	0.490	0.549	0.601	0.679 ***
	(0.0749)	(0.193)	(0.397)	(0.174)	(0.285)	(0.358)	(0.398)	(0.509)	(0.201)
CEE*SCG	0.0910	0.150 ***	0.171	0.233	0.262	0.313	0.351	0.408 ***	0.529 ***
	(0.0693)	(0.0476)	(0.151)	(0.209)	(0.301)	(0.353)	(0.258)	(0.150)	(0.148)
HCE*SCG	0.288 ***	0.214	0.250	0.331	0.360 ***	0.401	0.469	0.480	0.559 ***
	(0.0679)	(0.183)	(0.199)	(0.416)	(0.134)	(0.339)	(0.396)	(0.418)	(0.121)
SCE*SCG	0.676 ***	0.638 ***	0.555	0.492	0.415	0.370	0.343	0.280	0.180
	(0.226)	(0.251)	(0.429)	(0.461)	(0.358)	(0.338)	(0.418)	(0.459)	(0.273)
ESG. F	0.781	0.793	0.702	0.629	0.593	0.558	0.821	0.339	0.771 ***
	(0.723)	(0.778)	(0.618)	(0.593)	(0.499)	(0.514)	(0.771)	(0.562)	(0.203)
COVID-19	−0.131	−0.119 ***	−0.158	−0.273	−0.318	−0.422	−0.456	−0.519	−0.661 ***
	(0.0991)	(0.0315)	(0.114)	(0.237)	(0.291)	(0.418)	(0.419)	(0.591)	(0.193)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ps. R2	0.122	0.129	0.151	0.169	0.182	0.192	0.194	0.197	0.213

Notes: This table presents the effect of confounding factors such as ESG Funds and Covid-19 between sustainable growth rate (SGR) and value-added intellectual coefficient (VAIC) and moderating variables such as sustainable corporate governance (SCG) and military-experienced CEOs (MCEOs). *** Significance at 1% level, ** Significance at 5% level, and * Significance at 10% level. Source: Author's Estimations.

5. Conclusions

The nexus between intellectual capital and sustainable growth is essential for the enduring success of organizations, especially among Chinese non-financial firms, in an increasingly linked world. Intellectual capital, encompassing physical, human, and structural capital, is crucial in fostering innovation, enhancing efficiency, and providing a competitive advantage. This study investigated the effect of IC on the SGR through newly introduced moderators, specifically MCEOs and SCG. A quantile regression analysis revealed a strong positive relationship between the VAIC and SGR in Chinese non-financial firms across various quantiles. We also discovered that CEE, HCE, and SCE significantly and positively influence the SGR across multiple quantiles. The findings revealed that MCEOs and SCG favorably moderated the effects of the VAIC, CEE, HCE, and SCE on the SGR in Chinese non-financial firms. This indicates that as the MCEOs and SCG rise, the influence of these variables on the SGR becomes more significant.

Our findings may possess practical implications for policymakers and practitioners. Managers must recognize the significance of intellectual capital and allocate more resources toward it to promote collaboration, innovation, and sustainable practices. We need to enhance the VAIC and its specific measures to strengthen the SGR. Our findings indicate that policymakers and managers should promote the leadership of MCEOs, as they may effectively foster a culture of responsibility within the firm, enhancing transparency and ethical decision making. This culture can strengthen trust among shareholders and is vital for fortifying the relationship between internal communication and sustainable growth. The study's findings indicate that SCG strengthens the relationship between IC and the SGR. Consequently, policymakers should concentrate on enhancing the SCG, enabling Chinese non-financial firms to utilize IC more effectively for an increased SGR.

This study presents substantial future directions. This study exclusively examines Chinese non-financial enterprises. Therefore, we recommend investigating this subject in a country other than China. This study solely uses MCEOs and SCG as moderators to examine the relationship between IC and the SGR. Therefore, we encourage future researchers to consider the impact of other governance factors on this relationship. The focus on the VAIC and its components, CEE, HCE, and SCE, constrains this study.

Consequently, examining this relationship with MVAIC and its metrics CEE, HCE, SCE, and RCE is advisable. The impact of the 2007–2008 financial crisis as a confounding variable is not considered in this study due to the dataset spanning from 2010 to 2022, which includes the ESG variable. The availability of ESG data in the Chinese market dates back to 2010. Consequently, prospective researchers should use this element as a confounding variable to assess the robustness of the results.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su162310533/s1, Table S1. Nexus between IC and SGR, Table S2. Nexus between Components of IC and SGR, Table S3. Nexus between IC and SGR with moderation of MCEOs, Table S4. Nexus between Components of IC and SGR with moderation of MCEOs, Table S5. Nexus between IC and SGR with moderation of SCG, Table S6. Nexus between Components of IC and SGR with moderation of SCG.

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