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## THE ROLE OF CORPORATE SOCIAL RESPONSIBILITY IN BUSINESS PERFORMANCE: THE MODERATION INFLUENCE OF BLOCKCHAIN TECHNOLOGY

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### ABSTRACT

Aim/Purpose	The major challenges for firms to initiate corporate social responsibility (CSR) arise from resource constraints, complexity, and uncertainty. Consuming considerable financial and human resources is the main difficulty for smaller firms or those operating in less profitable industries, and the lack of immediate outputs from CSR initiatives poses a challenge for firms in prioritizing and assessing their effectiveness.
Background	To better integrate CSR management into overall business strategy and decision-making processes, Blockchain technology (BCT) could potentially offer a feasible and optimal alternative to CSR reports.
Methodology	This study uses the fixed effects regression by way of the Least Squares Dummy Variable (LSDV) approach in STATA to analyze the direct effect of CSR management on business performance and the moderating effect of BCT adoption on this relationship with a panel data set of 5810 observations collected from the 874 listed companies in 2015 in Taiwan Stock Exchange through 2021.
Contribution	This study contributes to the literature by shedding light on the organizational factors that influence BCT adoption.
Findings	The findings show that firms with high levels of CSR management have better business performance. Additionally, the adoption of BCT strengthens the positive relationship between CSR management and business performance, but it cannot replace the fundamental principles of CSR. Finally, firm size does not significantly affect BCT adoption, indicating that companies of all sizes have an equal opportunity to adopt BCT, which can help to level the playing field in terms of resources available to different firms.

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Recommendations for Practitioners	This study suggests that firms managing CSR practices have better business performance, and the adoption of BCTs further enhances this positive relationship. However, BCT adoption does not have the same positive effect on business performance as CSR practices. Additionally, this research can help to inform public policy related to BCT adoption and diffusion.
Recommendations for Researchers	By exploring the factors that influence BCT adoption, future researchers can provide insights into the key challenges and opportunities faced by organizations of different sizes and help to develop strategies for promoting the effective adoption of BCT.
Impact on Society	Given the limitations of current CSR reporting, the understanding gained from BCT applications can provide companies with an alternative mechanism to foster progress in CSR implementation.
Future Research	Firstly, while the fixed-effects model might have dampened the power of explanation because it only captures within-unit variation and ignores between-unit variation, the explanatory power is further limited due to only integrating two independent variables in this model. Because of limited data availability, this study only utilizes CSR_Report and firm_size as independent variables. Future studies can consider more key factors and may lead to different results. Additionally, panel data is collected from Taiwan and, therefore, may not be representative of the broader population. Future researchers integrating the Stock Exchange of different countries are recommended.
Keywords	corporate social responsibility, blockchain technology, business performance, fixed-effects model, Taiwan Stock Exchange

## INTRODUCTION

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On October 12, 2022, a BBC News headline (Gelbart et al., 2022) reported that refugee families in Syrian camps were begging for donations on TikTok, a social media platform, while the company took up to 70% of the proceeds, and a middleman who provided families with the phones and equipment to go live took 35% of the remainder. To understand the whole story and track where the money goes, the BBC ran an experiment and found that of the BBC's \$106 (€100) gift just \$19 finally reached a refugee family. This event raises two major concerns regarding Internet usage: corporate social responsibility (CSR) of social media and the role of intermediaries (i.e., middlemen). After the development of Web 2.0 technologies for decades, researchers have identified some drawbacks of the Internet, including the security, privacy, audit transparency, and quality of service (Bezahaf et al., 2020; Keshav, 2018; Roman et al., 2013; Rudman, 2010). Blockchain technology (BCT) may provide promising solutions for these issues.

The growing research investigating economic, environmental, and social responsibilities in the business context (Elkington, 1994) has confirmed the positive relationship between CSR implementation and competitive advantages (Adamik & Nowicki, 2019; Cegliński & Wiśniewska, 2017; Hadj et al., 2020). Companies around the world have recognized the need to balance the triple bottom lines, and sustainability reporting is acknowledged as an effective instrument to show a corporation's sustainability commitment (Castelo, 2013). However, as CSR-related reports are deemed a fundamental aspect of corporate governance and responsibility, many business leaders are still reluctant to invest in CSR (Wagner, 2005) largely due to the consideration of cost-and-benefit analysis (Sharma & Vredenburg, 1998). For users, the price that they have to pay may dominate their decision of technology adoption (Brown & Venkatesh, 2005; Coulter & Coulter, 2007). By contrast, the cost to implement BCT is much cheaper than the annual cost of CSR reporting, and, in the meantime, BCT applications improve speed and real-time monitoring of CSR performance and thus can prevent businesses such as TikTok from violating human rights in the first place.

Regarding the concern of intermediaries, a firm's main goal is to improve its efficiency by coordinating the various members of a supply chain network to achieve a competitive advantage over its rivals. However, the increasing flow and volume of information at all stages of operations today has weakened a company's efficiency and performance (Sabet et al., 2017) due to the issues with transparency, security, durability, and process integrity (Francisco & Swanson, 2018; Saberi et al., 2018; Vaio & Varriale, 2020; Wamba & Queiroz, 2019). In particular, the existence of intermediaries in supply chains increases the likelihood of potential power abuse such as deceitful and cheating activities (Grover & Malhotra, 2003; Ketchen & Hult, 2007). Although the Internet has mitigated some problems, supply chain entities still face various challenges such as defending against hacking and corruption as well as maintaining quality, costs, speed, reliability, and sustainable growth (Dong et al., 2017; Kshetri, 2018). These obstacles could be resolved through BCT which provides high-level security of information and a robust environment for different actors in the network (Abeyratne & Monfared, 2016; Kamble et al., 2018).

In academia, several theoretical approaches regarding IT adoption literature, such as technology acceptance model (TAM) and the diffusion of innovation theory (DOI), are utilized to assess user intention towards information technology (IT). TAM and DOI share a similar proposition that IT with perceived usefulness (PU) features are more likely to be adopted (Davis, 1989; Rogers, 1995), and a handful of researchers further integrated these two models into a framework to examine user intention (Al-Rahmi et al., 2019; Lee et al., 2011). Building upon the above integrated framework, PU in this study refers to the degree to which companies believe that adopting BCT can lead to stronger CSR and competitiveness which in turn provides them with expected benefits, including the reduction of the cost and the saving of efforts and time. Nevertheless, little research has been conducted on the relationship between BCT and CSR. This study proposes that BCT serves as a promising innovative approach in improving CSR commitments by way of Environmental, Social, and Governance (ESG) disclosure. Eventually, BCT empowering information in real-time may replace paper-based sustainability reporting and become an effective tool for companies to show a genuine commitment to CSR since sustainability reporting faces problems of costly and time-consuming, information overload, and data from various sources (Herzig & Schaltegger, 2011; Isaksson & Steimle, 2009; Thoradeniya et al., 2022).

Using the fixed effects model to analyze the BCT effect on business performance with a panel data set on 30 companies in 6 Asian countries from 2015 through 2019, this study is expected to make contributions in theoretical and managerial ways. Theoretically, this study expands the overall CSR research through BCT use to the extent that it initiates the examination of blockchain-based supply chain benefits that may as well fulfill the same requirements that constitute the substantial factors for CSR, which has yet to be addressed integrally and effectively. The result increases the generalizability of the CSR model to a different context (e.g., supply chain) which is an important step to advance a theory (Alvesson & Kärreman, 2007). Practically, given the limitations of current CSR reporting (Pucker, 2021; Tschopp & Huefner, 2015; Turzo et al., 2022), the understanding gained from BCT applications can provide companies with an alternative mechanism to foster progress in CSR implementation.

## **THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT**

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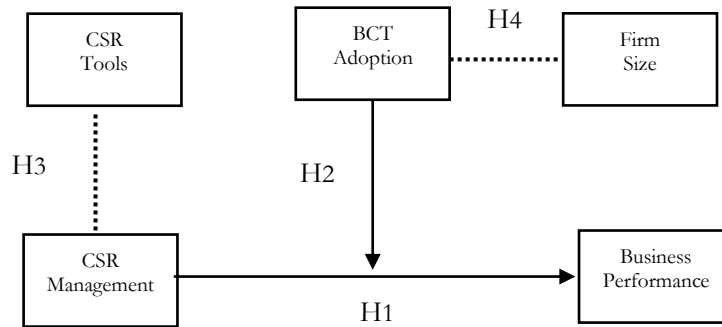
This study proposes a conceptual framework, as shown in Figure 1, to highlight the moderation effect of BCT practices on the relationship between CSR management and business performance. In the following sections, the expected relationships among CSR management, BCT practices, and business performance are discussed with literature support, and these hypotheses relating to these variables are developed:

H1: Firms with high levels of CSR management (by adopting at least one of the sustainability reports) will have high levels of business performance.

H2: BCT adoption will strengthen the positive relationship between CSR management and business performance.

H3: BCT adoption has a similar effect as CSR tools for firms on business performance.

H4: Firm size has significant effects on BCT adoption.



**Figure 1. Conceptual framework**

In Figure 1, firm size and CSR tools are drawn as a dotted line to represent their unique nature and differentiate them from other variables. They are not assumed to be directly affected by other variables but rather serve the purpose of accounting for potential confounding factors.

### ***CSR MANAGEMENT***

CSR management has grown considerably over the past decades as it mainly refers to a set of activities undertaken in terms of social and environmental responsibilities while pursuing financial growth in a firm (Carroll, 1999). With the growth of the CSR concept among the public and the increasing pressures from stakeholders, a variety of CSR strategies have been introduced such as investments in innovative activities regarding products and management (Albino et al., 2009), investments in human and ecological capability (Griffiths, 2004), and integration of economic, natural, and social capital into the business decision making (Dyllick & Hockerts, 2002). By doing so, a firm may improve its reputation, which in turn strengthens its brand, enlivens morale, and raises the value of its stock (Firestein, 2006; Porter & Kramer, 2006). To create a strong reputation, business leaders are required to effectively integrate CSR practices into their policies and strategies.

The literature presents extensive arguments for why companies should undertake CSR initiatives. From the perspective of social exchange theory (SET), the reciprocity norm is the fundamental concept that people are obligated to help those who have helped them (Blau, 1964; Gouldner, 1960). When companies proactively provide welfare for their employees, the employees will in return respond to the companies with positive behavior (Aryee et al., 2002; Gould-Williams & Davies, 2005). Subsequently, companies and their employees engage in reciprocal behaviors, and this interaction provides the foundation for the development of closer bonds (Graca et al., 2015). An effective CSR implementation triggers a social exchange process between the company and its employees, helping employees gain self-efficacy, experience the value of their work, and, therefore, advance both individual and organizational performance (M. Chen & Lin, 2012; Nazir et al., 2021).

From the perspective of social identity theory (SIT), people tend to assign themselves to attractive, unique, and respected social groups to satisfy their underlying needs for emotional well-being and self-esteem (Turner, 1975). Self-categorization, a component of social identity theory, further explains that individual behaviors will be in line with the relevant group prototype (Hogg & Terry, 2000). If a salient group is distinctive and prestigious in competition with other groups, members

with the desire for self-definition in this group will need to make a favorable or positive evaluation of themselves (Turner, 1975) by producing constructive behaviors such as positive attitudes, cohesion, cooperation, altruism, empathy, and mutual influence (Hogg & Terry, 2000). Companies with good CSR performance are deemed salient groups that have greater prominence in the minds of stakeholders and thus build up a strong reputation (Rindova et al., 2005). On one hand, studies suggested that people with higher education background are more likely to work for companies with a good reputation for CSR (Montgomery & Ramus, 2003). CSR initiatives become an appropriate tool for marketing to prospective employees (Gond et al., 2010). On the other hand, by identifying companies known for CSR, employees enhance pride and self-esteem (Jones, 2010), augment perceived external prestige (H. R. Kim et al., 2010), and improve satisfaction and, thus, contribute to performance at work (De Roeck et al., 2014). Both theories support CSR practices that may lead to strengthening a firm's reputation and in turn become an intangible resource with heterogeneity and retention of employees (Barney, 1991). Ultimately, effective CSR management may generate significant profits.

Measuring a firm's CSR performance is a powerful tool for the stakeholders to influence corporate behavior. To get higher rankings, firms may use mechanisms to reinforce their CSR practices so that a clear signal is sent about the firm's commitment towards CSR (Bansal & Hunter, 2003). Early scholars proposed the total responsibility measurement (TRM)/ total quality measurement (TQM) approach focusing on the triple-bottom-line of economic, social, and environmental issues (Gorenak & Bobek, 2010; Waddock & Bodwell, 2002). Lately, advocates suggested that the disclosure of environmental, social, and governance (ESG) standards contributes to a better business reputation with competitive advantages and higher performance (Gardberg & Fombrun, 2006; Lee Brown et al., 2009; Simnett et al., 2009; Steyn, 2014). Numerous empirical studies showed that sustainability reports, such as the Global Reporting Initiative (GRI), send a clear signal about a firm's commitment towards CSR (Lock & Seele, 2016; Wanner & Janiesch, 2019). Likewise, certified management systems endorsed by well-known institutional intermediaries, such as ISO and SA series, can be regarded as an indication of responsibility and concern for stakeholder relations from the companies (Rindova et al., 2005). As these approaches are a mechanism for continual improvement over time, a firm implementing a management system with one of these certifications is regarded as a sustainable commitment towards CSR (Darnall, 2006; Rondinelli & Vastag, 2000).

CSR management is expected to improve a firm's reputation and in turn competitive advantages through certification to international standards. C. H. Chen and Hsiao (2020) suggested that international certifications are not only a feasible and optimal tool for firms to demonstrate their commitment to CSR, but also help stakeholders distinguish CSR companies from non-CSR companies. As certification standards may serve as a tool for evaluating a firm's CSR management over time, the measured indicators used in this study include ESG certification, GRI reports, ISO series, and SA 8000.

### ***BUSINESS PERFORMANCE***

Business performance refers to how well a firm achieves its goals, mainly indicating profitability. The short-term objectives of CSR management are primarily to increase customer engagement and maximize shared value in terms of social, environmental, and governance challenges, while the long-term objective is to build a better reputation and in turn increase profits for firms. The empirical literature has acknowledged the positive effects of CSR management on business performance in terms of financial performance (Aupperle et al., 1985; Cheng et al., 2014; Perez-Batres et al., 2012; Rettab et al., 2009) and non-financial performance including competitive advantages (Flammer, 2013; Porter & Kramer, 2006; Yang et al., 2013) and reputation (Turban & Greening, 1997; Vlachos et al., 2013).

Indicators to evaluate business performance are mainly based on market-related, operational, and financial reports that have served as a tool for comparing firms and evaluating a firm's profits over time (Waddock & Graves, 1997; Wright et al., 2006). Recent studies have adopted stock price to measure the financial performance influenced by CSR disclosure (Hunjra et al., 2020; Mohammad &

Wasiuzzaman, 2021; Tasnia et al., 2021), and the same indicator will be adopted to measure business performance in this study.

Based on the above literature review of CSR management and business performance, this study proposes the first hypothesis:

Hypothesis 1 (**H1**): Firms with high levels of CSR management (by adopting at least one sustainability report) will have high levels of business performance.

### ***THE MODERATING ROLE OF BCT ADOPTION***

BCT adoption refers to a firm utilizing an innovative way to implement decentralization, facilitate a secure setting, improve data recovery, reduce degrees of shortcoming, and optimize asset dispersion (Kamarulzaman et al., 2021). Blockchain technology keeps things secure by using decentralized networks. Instead of having one central authority in control, it involves a whole community of people. This means that no single person or organization can have all the power or change things on their own. The primary purpose of BCT is to verify the authenticity of digital data, and its applications can provide enhanced security and privacy in varied domains. Currently, this novel innovation has been largely implemented in the banking and finance industries, and it has potential to transform diverse non-monetary systems such as online voting, healthcare, proof-of-location, supply chain, and cybersecurity (Miraz & Ali, 2018). For instance, the main benefits of BCT applications in supply chain management (SCM) include fraud prevention, privacy protection, trustworthiness, efficiency, and transparency (Kshetri, 2018; Veuger, 2018; Viryasitavat et al., 2018). Since the traditional supply chain is mostly under control by authorized actors who might be corrupt individuals and organizations (Sarker et al., 2021), BCT helps detect unethical suppliers and counterfeit products and thus allows businesses in the supply chain to reach transparent information and efficient exchange so that consumers can fully grasp the production process of the raw material and learn the impacts on the environment and society. This disruptive technology has its actual potential for firms to resolve the problems that have long plagued the business and thus gain a competitive advantage.

Empirical studies found that some companies adopting BCT improve several operations and performance, such as the wine sector which overcomes product counterfeiting (Adamashvili et al., 2021; Biswas et al., 2017), the food industry that provides customers with transparent traceability of the entire journey of a product across the chain network (R. Y. Chen, 2018), the financial sector that enhances security without intermediaries in transactions (Crosby et al., 2016; Guo & Liang, 2016), and the service industry that increases confidentiality, transparency, and trustworthiness (Barenji et al., 2020; Kim & Laskowski, 2017). In this sense, the merits of BCT are highly applicable to CSR initiatives. However, little has been studied to examine the relationship between BCT and CSR practices.

A firm obtaining a CSR international certification generally exhibits the following key features: accountability, transparency, responsibility, and competitiveness (C. H. Chen & Hsiao, 2020). By implementing CSR, companies can build trust and credibility among stakeholders, enhance their reputation, and contribute to long-term sustainability. CSR also helps in aligning business goals with societal expectations and creating a positive impact on society and the environment. (Wood & Winston, 2007). Since the decay of integrity causes dysfunction in the management system with the huge costs involved, the traceability of BCT can solve the problems and help foster accountability in governance. Transparency of CSR is intended to ensure and strengthen public confidence in the quality and effectiveness of the products and services, contributing to an increase in credibility of a firm's reputation (Jensen, 2002). Being tamper-proof, BCT allows consumers to verify the original source and view the full record, making it impossible to hide transactions and easy to track data entries.

The responsibility of CSR demonstrates the commitment that a firm has well structured and integrated management systems for its business activities (Bansal & Hunter, 2003), such as issues of data security. The encryption of BCT not only protects personal data against hackers, but also identifies trans-

acting parties to each other and validates their identity before executing any exchange. The competitiveness of CSR shows in connection with a positive image of a firm that has met CSR standards and has been acknowledged by accreditation and certification systems (Jorgensen et al., 2006). In other words, CSR brings about a strong positive reputation for firms and, therefore, leads to competitiveness. Likewise, the key traits of BCT-based solutions can generate similar or even better outcomes. With BCT implementation, firms may develop good a reputation that its supply chain is verifiable, transparent, immutable, and traceable. Subsequently, competitiveness comes along with strong reputation (Jorgensen et al., 2006). The above arguments lead to the second hypothesis:

Hypothesis 2 (**H2**): BCT adoption will strengthen the positive relationship between CSR management and business performance.

The literature has examined the relationship between business performance and CSR management by using sustainability reports. Nevertheless, little literature has analyzed the huge cost of investment (e.g., capital, time, and labors) on these types of CSR disclosure as firm size is neglected as a significant determinant (Fikru, 2014; Sharma, 2005). Large firms with high levels of sources of finance (e.g., credit from banks) and the concern of international connectivity would make investments on CSR which promises long-term benefits but hurts short-term financial results (Semenova, 2021), while small-and medium-size enterprises (SMEs) with limited resources in manpower and capital may be intimidated not to take actions on CSR implementation.

Additionally, several drawbacks constrain these CSR tools, including falsification, misreporting, misrepresentation, cost, and time consumption (Karpoff, 2021; Kurpierz & Smith, 2020; Reurink, 2018). In terms of social responsibility, for instance, a large firm demonstrates its commitment in response to the effects of its activities by adopting SA8000, which may not address critical issues (Balal & Roberts, 2010) and, therefore, not result in any competitive advantage (Merli et al., 2015) while at the same time increase the expenses incurred for the certification (Stigzelius & Mark-Herbert, 2009). By contrast, a SME without holding any CSR certifications can achieve the same effect with less expenses by providing the access (e.g., QR code) for the customers to understand the entire journey of a product or the raw material with its historical information on the blockchain. Meanwhile, the unique traceability also improves social responsibility by providing consumers with product information, such as if it is made from ethical sources. In this context, international organizations such as Organization for Economic Cooperation and Development and World Economic Forum advocate the use of BCT to overcome these obstacles due to its real-time traceability and immutability properties (Bakarich et al., 2020; Nikolakis et al., 2018). Building upon this logic, this study proposes two more hypotheses:

Hypothesis 3 (**H3**): BCT adoption has a similar effect as CSR tools for firms on business performance.

Hypothesis 4 (**H4**): Firm size has significant effects on BCT adoption.

## METHODS

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### *RESEARCH DESIGN*

The study is a cross-sectional design with a quantitative approach. It aimed to investigate the relationship between CSR management and business performance, as well as the moderating effect of BCT adoption on this relationship. The study employed a dichotomous variable to represent CSR management (1=CSR reporting; 0=non-CSR reporting) and used the average annual stock price of a firm as the dependent variable. Furthermore, BCT adoption was considered a dichotomous moderating variable (1=BCT adoption; 0=non-BCT adoption), while firm size was used as a control variable.

### ***DATA SOURCE, SAMPLING, AND PROCESSING***

The study utilized a panel dataset that consisted of cross-sectional units with total 874 listed companies in Taiwan Stock Exchange (TWSE, n.d.) for the 2015-2021 period. To reach balanced panel data, any company that had been delisted, emerged, or issued an IPO during these years was removed, and therefore 830 were valid. As a result of this filtering process, the panel data contains 4 indicators (CSR Report, log Annual Average Stock Price, BCT Adoption, and Firm Size) for a panel of 830 companies across 7 years (2015 to 2021). Accordingly, 5810 (830×7) firm-year observations were collected for testing hypotheses.

### ***CONSTRUCT MEASUREMENT***

For the independent variable CSR management, this study adopted sustainability reports disclosed in the Market Observation Post System (MOPS; Corporate Governance Center, n.d.), an ESG information and inquiry platform indicating firms that voluntarily implement sustainability principles and take steps to support CSR goals. CSR management was represented by a dichotomous variable with a value of 1 to denote a firm’s disclosure in the year and 0 to otherwise. The dependent variable business performance was mainly represented by the average annual stock price of a firm (Hunjra et al., 2020; Mohammad & Wasiuzzaman, 2021; Tasnia et al., 2021). For the moderator BCT adoption, the measure was based on a firm’s annual reports submitted to TWSE, denoting 1 for the firm that officially initiates BCT applications in the year and 0 for otherwise. For control variable firm size, this study used market capitalization as the indicator and based on the measure proposed by the U.S. Securities and Exchange Commission denoting 1 for the firm with value of \$10 billion or more (large-cap), 2 with value between \$2 billion and \$10 billion (mid-cap), and 3 with value less than \$2 billion (small-cap).

### ***STATISTICAL ANALYSIS***

Generally, three types of regression for panel data are Pooled Ordinary Least Squares (POLS), fixed-effects model, and random effects model. Since POLS focuses only on dependencies between the entities and ignores time and individual characteristics, it may be inappropriate for this study. Therefore, this study needed to decide between fixed- or random-effects model, and the equation for the regression was:

$$Y_{it} = a + \beta X_{it} + \varepsilon_{it} \quad (1)$$

$i$  = Firm 1, 2, 3, ..., 830                       $t$  = Year 2015, 2016, ..., 2021

Where

$Y_{it}$  is the Annual Average Stock Price of Firm  $i$  in Year  $t$  (AVE)

$X_{it}$  represents variables that may contain explanatory variable (CSR\_Report), control variable (firm\_size), and moderating variable (BCT\_adopt) of Firm  $i$  in Year  $t$

$a$  is the intercept

$\beta$  is the coefficient of variable  $X$

$\varepsilon_{it}$  is the error term

The process of selecting the regression model for the panel data went through three phases by using Stata. Firstly, the Hausman Test (Hausman, 1978) was conducted to compare both fixed effects and random effects models. If the null hypothesis is rejected ( $p < 0.05$ ), a significant fixed effects model rather than the random effects counterpart exists. Next, once the model was chosen, entity and time fixed effects with and without adding control factors needed to be further tested. The purpose of this



task was to choose a better approach to achieve *ceteris paribus*, that is, to study the effect of CSR management on business performance as other things remain constant. Finally, the moderator BCT adoption is included to see if this dummy variable affects the relationship between CSR management and business performance.

## DATA ANALYSIS & RESULTS

### PHASE 1

As shown in the Table 1, the Hausman test shows that Probability value (Prob>chi2) is less than 0.05. It indicates that the endogeneity exists, and thus fixed-effects model would be the suitable type of regression for this study.

**Table 1. Results of Hausman fixed random**

	(b) fixed	(B) random	(b-B) Difference	Std. err.
CSR_Report	.2134	.2087	.0047	.0059
firm_size	.1121	-.3181	.4601	.1031
BCT_adoption	.1925	.1876	.0049	.0029

Note: b=Consistent under  $H_0$  and  $H_a$ ; B=Inconsistent under  $H_a$ , efficient under  $H_0$ ;  $\chi^2 = 23.51$ ; Prob> $\chi^2=0.0000$

The use of fixed-effects models is to address the issue of unobserved heterogeneity that might exist between the firms and over time. In other words, if the fixed-effects model is confirmed, entity and time fixed effects need to be taken into consideration. Meanwhile, this study integrates some influential and control factors in the model to increase explanatory power and improve insights. Consequently, the equations for the combined model become:

$$Y_{it} = \alpha_i + \beta X_{it} + \lambda_t + \varepsilon_{it} \quad (2)$$

Where

$\alpha_i$  is specific intercept as the fixed effect of Firm  $i$

$\lambda_t$  is specific intercept as the fixed effect of Year  $t$

### PHASE 2

The combined model was carried out by Least Squares Dummy Variable (LSDV) techniques, which includes the individual effects represented by dummy variable in the regression model. By including Firm fixed-effects, the models control for time-invariant unobserved heterogeneity across firms. In contrast, by including both Firm and Time fixed-effects, the models control for both time-invariant and time-varying unobserved heterogeneity across firms and over time.

The time-varying outcome variable is business performance, and independent variable is time-varying predictor CSR report. Regression coefficients represent the predictive relationship between these two variables while controlling for the differences between subjects (i.e., firm ID/category) on the predictors. The output was shown in Table 2.

The R-squared estimates the proportion of the variance in the dependent variable that is explained by the independent variable. Table 2 shows four different R-squared values for four different models that differ in terms of the fixed-effects included in the analysis. Specifically, columns 1 and 2 use firm fixed-effects models while columns 3 and 4 use both firm and time fixed-effects models. The comparison of the R-squared values across the four columns suggests that column 4 (0.1794) can lead to

a significant improvement in the model fit. Column 4 also shows that CSR report has a positive and significant effect on annual average stock price ( $\beta=0.0875, p < 0.01$ ), indicating that for a given firm, as CSR report varies across time by 1 unit, annual average stock price expects to increase by 0.0875. Therefore, control for both time-invariant and time-varying unobserved heterogeneity can improve the precision and accuracy of the estimation of the impact of CSR management on the business performance. Hypothesis 1 is supported.

**Table 2. Regression results for all fixed-effects models**

	(1)	(2)	(3)	(4)
Variables	Firm FE 1	Firm FE 2	Time FE 1	Time FE 2
CSR_Report	0.2340*** (0.0295)	0.2134*** (0.0293)	0.0878*** (0.0276)	0.0875*** (0.0276)
firm_size		0.1120*** (0.0058)		0.1977*** (0.0074)
BCT_adoption		0.1925*** (0.0348)		0.0536 (0.0367)
Constant	3.224*** (0.0125)	2.8930*** (0.0233)	3.2066*** (0.0149)	2.6410*** (0.0293)
Observations	5810	5810	5810	5810
R-squared	0.0243	0.0408	0.1778	0.1794
Number of Firm	830	830	830	830
Firm FE	Yes	Yes	Yes	Yes
Year FE			Yes	Yes

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1 Robust Standard errors in parentheses.

In addition, this study compares the impact of BCT and CSR on business performance, respectively, by including firm size as control variable. The magnitude of the coefficient for CSR\_report (0.0875) is larger than the coefficient for BCT\_adoption (0.0536), suggesting that CSR\_report has a stronger impact on business performance than BCT\_adoption does. Moreover, the coefficient of CSR\_report is positive and significant while BCT\_adoption shows positive but negative. Based on these two results, CSR\_report performs better than BCT\_adoption in this model, and therefore BCT is not a suitable tool to replace CSR report. H3 is not supported.

### PHASE 3

This study further tests the moderating effect of BCT adoption on the relationship between CSR management and business performance. In general, a moderator is a variable that affects the strength and/or direction of the relationship between the independent variable and the dependent variable. However, the moderator variable does not necessarily have to be directly related to the dependent variable (Edwards & Lambert, 2007). Likewise, even if the moderator (i.e., BCT\_adoption) in Table 2 is not statistically significant as a direct effect, this study can still make the inferences on the moderation hypothesis so long as the independent variable (i.e., CSR\_Report) is statistically significant. Consequently, the equation for this moderator variable is:

$$\log AVE_{it} = a_i + \beta_1 firm\_size_{it} + \beta_2 CSR\_Report_{it} + \beta_3 CSR\_Report * BCT\_adoption_{it} + \varepsilon_{it} \quad (3)$$

The results in Table 3 show that BCT\_adoption plays a significant moderating role on the relationship between CSR\_Report and log\_AVE. In other words, a firm adopting BCT may increase the level of CSR initiatives and thus have a stronger effect on the business performance. The positive effect of CSR is strengthened if firms adopt BCT, and therefore H2 is supported.

Meanwhile, both coefficients for firms with BCT\_adoption ( $\beta=0.2074, p < 0.01$ ) and without BCT\_adoption ( $\beta=0.1683, p < 0.01$ ) show statistically significant while firm\_size is not significant ( $\beta=0.1146, p=0.341$ ). The indication is twofold. First, firms engaging in CSR initiatives will have positive business performance no matter what the firm size is. Secondly, firms engaging in CSR initiatives and adopting BCT tend to have better business performance than those engaging in CSR initiatives but without adopting BCT. In this regard, it is not firm size but the compound effects of CSR and BCT that have significant effects on business performance. Therefore, H4 is not supported.

**Table 3. Moderating effects of BCT adoption**

Log_AVE	Coeff.	Std. err.	t	95% conf. interval	
firm_size	.1146	.1202	0.95	-.1211	.3502
CSR_Report	.2103***	.0212	9.91	.1688	.2519
CSR_Report×BCT_adoption					
0	.1683***	.0326	5.16	.1043	.2322
1	.2074***	.0260	7.98	.1566	.2584
cons	2.8871	.3440	8.39	2.2127	3.5615

Note: Fixed-effects (within) regression coefficients are displayed;  $F(4, 4976)=53.10$ ;  $\text{Prob}>F = 0.0000$ ; \*\*\*  $p < 0.001$ .

## FINDINGS AND DISCUSSION

Table 2 presents the results of fixed-effects regression models examining the relationships between various variables, including CSR report, firm size, and BCT adoption, and the control variable. The models include firm and time fixed effects, and the results suggest that column 4 can lead to a significant improvement in the model fit, which means controlling for both time-invariant and time-varying unobserved heterogeneity improves the precision and accuracy of the estimation. Consequently, the study found that CSR\_report has a positive and significant effect on log\_AVE, suggesting that CSR\_report has a stronger impact on business performance than BCT\_adoption does. Firms engaging in CSR initiatives will have positive business performance regardless of firm size, but firms engaging in CSR initiatives and adopting BCT tend to have better business performance than those engaging in CSR initiatives but without adopting BCT. Table 3 presents the results of a fixed-effects regression analysis that examines the moderating effects of BCT adoption on the relationship between CSR\_Report and Log\_AVE. The table shows that the coefficient for CSR\_Report×BCT\_adoption is positive and significant, suggesting that BCT adoption plays a significant moderating role on the relationship between CSR\_report and log\_AVE, and the positive effect of CSR is strengthened if firms adopt BCT. In other words, the positive effect of CSR\_Report on business performance is strengthened if firms adopt BCT. These findings draw the following discussions.

**H1** “Firms with high levels of CSR management (by adopting at least one of sustainability reports) will have high levels of business performance” is supported. This means that firms that adopt CSR management practices, such as publishing sustainability reports, have better business performance than firms that do not adopt these practices. This finding is consistent with previous research that

has shown a positive relationship between CSR and business performance (Aguinis & Glavas, 2012; Carroll & Shabana, 2010).

**H2** “BCT adoption will strengthen the positive relationship between CSR management and business performance” is supported. As some previous research has highlighted the potential of BCT to facilitate the implementation and monitoring of CSR practices (Ezzi et al., 2022; Srinivasan et al., 2020), this result is not only in line with the existing findings but further suggests that firms adopting both CSR and BCT have even better business performance than those that only adopt CSR practices.

**H3** “BCT adoption has a similar effect as CSR tools for firms on business performance” is not supported. This means that the BCT adoption does not have the same positive effect on business performance as CSR management. This may be due to the fact that BCT is a tool that supports the implementation of CSR practices, but it cannot replace the fundamental principles of CSR. Currently, CSR reports are still more important for business performance than BCT adoption.

**H4** “Firm size has significant effects on BCT adoption” is not supported. This result is encouraging as it suggests that companies of all sizes have an equal opportunity to adopt BCT, which can help to level the playing field in terms of the resources available to different firms. It is particularly relevant in the current business environment, where SMEs may struggle to compete with larger firms that have greater resources at their disposal. By adopting BCT, SMEs may be able to bridge this gap and achieve similar levels of efficiency and effectiveness in their CSR practices. Meanwhile, this result contributes to the existing literature by shedding light on the organizational factors that influence BCT adoption. While little research specifically focused on this relationship, understanding the impact of firm size on blockchain adoption can help organizations better prepare for and manage the implementation of this technology.

## CONCLUSION AND LIMITATIONS

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This study proposed a fixed-effects model to study the relationships among CSR management, business performance, and the BCT adoption by testing four hypotheses with a dataset of 5810 firm-year observations for the period 2015 through 2021. The managerial implications suggest that firms managing CSR practices have better business performance, and the adoption of BCT further enhances this positive relationship. However, BCT adoption does not have the same positive effect on business performance as CSR practices. Additionally, this research may shed light on the determinants of BCT adoption and diffusion across various industries and contexts. By identifying the key barriers and facilitators of BCT adoption, policymakers can design targeted interventions that promote the widespread use of BCT in an efficient manner. Finally, by exploring the factors that influence BCT adoption, future researchers can provide insights into the key challenges and opportunities faced by firms of various sizes and help to develop strategies for promoting the effective adoption of BCT.

The limitations of this study are threefold. Firstly, this study adopts fixed-effects models by assuming that the independent variables are time-invariant. However, if limited variation exists in the independent variables over time, the model may not be able to capture the effect of these variables accurately. Secondly, while the fixed-effects model might have dampened the power of explanation because it only captures within-unit variation and ignores between-unit variation, the explanatory power is further limited due to only integrating two independent variables in this model. Because of limited data availability, this study only utilizes CSR\_Report and firm\_size as independent variables. Future studies can take more key factors into consideration and may lead to different results. Finally, panel data is collected from Taiwan and therefore may not be representative of the broader population. Future researchers integrating the Stock Exchange of different countries are recommended.

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