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Agenda iFAIRS 2025

22th August 2025 Kuala Lumpur MALAYSIA

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Opening Ceremony	0900~0930
F	0930~1015
Refreshment	1015~1030
A	1030~1130
Lunch Break	1130~1300
I	1300~1415
R	1415~1530
Refreshment	1530~1545
S	1545~1645
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	CHAIR : Li-Hsun WANG	REVIEWERS : Li-Hsun WANG, Wen-Pin LIN
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F1	Influence of CEO Education Level on Company's Cost of Debt	Chien-Hui WU, Wei-Shun KAO, Chang-Cheng CHANGCHIEN, Chen-Yu CHEN
F2	The Influence of ESG on Firm Value and Overseas Development	Li-Hsun WANG
F3	The Two Faces of the Crowd: Herding Behavior in Retail Margin Trading	Chen -Yen SHA, Jian-De TSAI, Shu-Fan HSIEH

Session A

	CHAIR : Austin Rong-Da LIANG.	REVIEWERS : Austin Rong-Da LIANG, Jung-Hua CHANG
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A1	An Application of the Centipede Game on the Telecommunications Industry in Taiwan	Wei-Hsien LI, Alex K.H.CHANG
A2	A Study on Students' Self-Regulated Learning, Peer Learning, and Professional Competence: Satir's Communication Theory and Self-Integration Theory	Shan-Huei WANG, Jung-Hua CHANG
A3	Woman Hold up Half the Sky! Exploring the Influence of Different Gender CEO Endorsements in Advertising	Jung-Hua CHANG, Shan-Huei WANG, Yu-Ting HUANG
A4	A Research on the Virtual Art Exhibitions: An Application of Game Theory	Su-Chen CHU, Alex K.H. CHANG, Ju-Shin TSAI

Session I

	CHAIR : Ming-Che WU	REVIEWERS : Chang-Cheng CHANGCHIEN, Chien-Hui WU
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I1	The Impact of Liquidity on Stock Returns of Vietnamese Commercial Banks	Thu-Hoang THI, Jian-Hsin CHOU, Chao-Hui YEH
I2	Defensiveness Analysis of the ESG REIT Sectors During the COVID-19 Pandemic Spread	Ming-Che WU, Yung-Shi LIAU
I3	A 52-Week High Turnover-Based Investment Strategy and Its Performance Analysis	Ying-Mei HUANG, Chia-Yu CHUNG, Tsai-Yin LIN
I4	Does CEO Education Mitigate Stock Crash Risk?	Chu-Hsiung LIN, Wei-Shun KAO, Ching-Huey LIN, Chih-Hsuan LIN
I5	AI Empowerment and User Continuance in Investment Platforms	Hsing-Ching CHEN

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	CHAIR: Wen-Pin LIN	REVIEWERS: Natenapang Thongsri, Shan-Huei WANG
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R2	A Systematic Review of Knowledge Management Strategies for Organizational Performance	Yi-Mei HUANG, Tsung-Hao CHEN, Daniel Chan-Wei TSAI
R3	The Influence of Argument Strength and Valance on Online Incivility Adoption	Kuan-Fu-Yung GE, Chieh-Li LEE, Guan-Yu CHEN
R4	Sustainable Competitive Advantage and Firm Performance in Thailand's Small and Medium Enterprises	Natenapang THONGSRI, Poramate SAGGAPUNT
R5	How Does the Service Technologies Affect Customers' Intention to Dine at Restaurants? The Moderating Role of Technology Anxiety	Chun-Ming CHANG, Shao-Yu HSU, Jung-Jung CHANG, Jui-Huang CHANG, Wen-Yi TSAI

Session S

	CHAIR : Yun WANG	REVIEWERS : Yun WANG, Hsien-Ming CHEN
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S2	Exploring Decentralized ESG in RWA Ecosystem with the Socio-Technical Co-construction Framework	Shun-Ming CHANG, Chang-Cheng CHANGCHIEN, Meng-Hsiang HSU, Yu-Chuan HUANG
S3	The Influence of Consumers' Perceived Residual Value and Perceived Value on Purchase Intention: A Case Study of Second-Hand Luxury Bags	Yun WANG, Ying-Chi HSU
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Influence of CEO Education Level on Company's Cost of Debt

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Abstract

This study primarily explores the relationship between CEO education level and companies' cost of debt. The empirical results indicate that the companies of CEOs with doctoral degrees have lower future debt costs. Moreover, CEO duality and accounting conservatism moderate the relationship between CEO education level and corporate debt costs. The results demonstrate that in companies with strong accounting conservatism and without CEO duality, having a CEO with a doctoral degree can effectively reduce corporate debt costs.

Keywords: CEO education level, Cost of debt, CEO duality, Accounting conservatism

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1. Introduction

After the global financial crisis, financial stability reporting and decision-making enabled firms to strategically increase their total assets, with this primarily occurring through debt leverage, which facilitated their recovery. A firm's debt ratio reflects its risk level, and poor financing choices can lead to financial instability and adverse outcomes. Conversely, sound financial decisions can enhance performance and profitability (Abu-Rub, 2012). Jiang et al. (2021) reported that issuing corporate bonds improves economic efficiency, especially in competitive markets. The decision for a company to issue corporate bonds is influenced by various factors, including funding needs, economic and market conditions, as well as the company's own creditworthiness and financial situation (de Oliveira et al., 2024). Notably, a CEO's educational background significantly impacts financial decisions, a relationship largely overlooked in prior studies (Saidu, 2019). The current study explores how CEO education affects corporate debt costs.

Upper echelons theory (Hambrick and Mason, 1984) suggests that the strategies of top executives are shaped by their experiences, values, and personal traits, including their education level. Spence (1973) argued that educational attainment signals cognitive abilities and work quality, and Saidu (2019) confirmed that CEOs being highly educated has a positive influence on firm performance. Educated CEOs are likely to use their expertise to improve performance and reduce debt costs. However, Tseng et al. (2017) warned that highly educated CEOs may exhibit overconfidence, leading to excessive risk-taking. Given that CEOs are the key decision-makers in a firm, their education level significantly impacts risk management and investment decisions. According to upper echelons theory, attaining a higher education level enables CEOs to make better strategic decisions and lower corporate debt costs. Thus, the current study examines the relationship between the education level of CEOs and their organization's corporate debt costs, proposing the following hypothesis:

Hypothesis 1: The higher a CEO's education level is, the lower their company's corporate debt costs are.

Sound corporate governance generally mandates that the roles of the CEO and Chairman be separate to avoid power concentration and a lack of oversight (Fama and Jensen, 1983). Barro and Lee (2013) highlighted that education reflects human capital

and intellectual capacity, and therefore, a CEO's educational background is a key indicator of their knowledge and skills. Human capital theory suggests that a higher level of education is correlated with better leadership and decision-making and thereby improves corporate performance (Hambrick and Mason, 1984). For example, CEOs having an MBA signals strong risk management abilities (Bertrand and Schoar, 2003).

Stewardship theory posits that a CEO who also serves as Chairman prioritizes their organization's long-term interests, favoring low-risk strategies (Donaldson and Davis, 1991). Daily and Dalton (1994) noted that CEOs playing dual roles reduces information asymmetry by leading to a controlled information flow. However, agency theory indicates that when a CEO is also a Chairman of the board, oversight is weaker, and the board's independence and objectivity are compromised, potentially adversely affecting performance and shareholder interests (Fama, 1980). The current study uses CEO duality—that is, whether a CEO is also the Chairman—as a measure of corporate governance to explore how the education level of a CEO affects corporate debt costs under varying governance structures. The following hypothesis is proposed:

Hypothesis 2: In companies with CEO duality, the relationship between the education level of the CEO and corporate debt costs is weakened, and therefore, the reduction in debt costs associated with CEO education level is smaller.

In addition to corporate governance, accounting conservatism may moderate the effect of CEO education level on corporate risk. Accounting conservatism, in which the cautious recognition of potential losses is prioritized (Watts, 2003), enhances transparency and reduces information asymmetry (LaFond and Watts, 2008). When conservative accounting is practiced, a CEO's education level acts as a stronger positive signal to investors (Spence, 1973), influencing their perception of the company's prospects. By contrast, in less conservative firms, CEOs may use their education and reputation to engage in earnings management to obtain short-term gains, increasing information risk (Ahmed and Duellman, 2013).

From the perspectives of signaling and human capital theory, accounting conservatism can enhance the corporate risk-mitigating effects of CEO education level because well-educated CEOs are better equipped for risk management (Hambrick and Mason, 1984). However, an overly high level of education may lead to overconfidence, prompting riskier decision-making and increasing company risk (Li and Tang, 2010).

Thus, although accounting conservatism can strengthen the positive effects of CEO education, potential negative outcomes due to overconfidence may still arise. Accordingly, the study proposes the following hypothesis:

Hypothesis 3: In companies with higher accounting conservatism, the relationship between the education level of the CEO and corporate debt costs is stronger, indicating the reduction in debt costs associated with education level is greater.

This study uses a sample of Taiwanese listed companies from 2009 to 2022, employing the debt-to-corporate-financing structure ratio (DCFS) as an indicator of corporate debt costs and examining the influence of education level of the CEO on such costs. The empirical results demonstrate that higher CEO education levels are linked with reduced corporate debt costs. This debt costs–lowering effect of education level of the CEO is more pronounced in companies with stronger corporate governance and more conservative accounting practices. In summary, as a key decision-maker, the CEO’s education level plays a significant role in corporate risk management and investment decisions. This study, grounded in upper echelons theory, investigates whether CEO education level can effectively reduce corporate debt costs. Additionally, by focusing on Taiwan—an emerging market that differs from developed markets in terms of governance mechanisms and accounting conservatism—this research sheds light on the influence of the education level of CEOs in emerging markets, which has not yet been explored.

The remaining content of this paper is organized as follows: Section 2 introduces the research methodology, Section 3 presents an analysis of the empirical results, and Section 4 concludes the study.

2. Methods and data

This study focuses on publicly listed companies in Taiwan, using data sourced from the Taiwan Economic Journal database. The data include companies’ financial variables, accounting variables, corporate governance variables, and stock prices. The study was conducted from 2009 to 2022. After companies from the insurance and securities industries and those with missing data are excluded, 969 listed companies were included in this study.

2.1 Variable measurement

This section presents the definitions of CEO education level, cost of debt, CEO duality, accounting conservatism, and control variables and details the approaches employed to measure these variables. All variables used in this study are measured annually.

2.1.1 CEO education level

According to Habib et al. (2017), a CEO's education level may reflect their proficiency in risk management and performance forecasting. Therefore, this study examines the influence of CEO education level on the cost of debt of a company. To measure CEO education level, a dummy variable called *EDU-MP* is defined; *EDU-MP* equals 1 if the CEO holds a master's degree or higher and 0 otherwise. The CEOs with *EDU-MP* = 1 are further divided into two groups: those holding a master's degree (*EDU-M*) and those holding a doctoral degree (*EDU-P*). *EDU-M* equals 1 if the CEO holds a master's degree and 0 otherwise. Similarly, *EDU-P* equals 1 if the CEO holds a doctoral degree and 0 otherwise *EDU-P*.

2.1.2 Cost of debt

Van Horne and Dhamija (2012) indicated that finance managers often rely on senior debt and equity to finance investment projects because senior debt can be obtained at lower borrowing costs from financial institutions and can help with avoiding agency costs associated with borrowing. In this study, the DCFS is used as a measure of a company's cost of debt to examine the effect of CEO education level on cost of debt.

2.1.3 CEO duality

This study uses the dual role of CEO and Chairman as a proxy for corporate governance quality. If the CEO of firm i also serves as its Chairman in year t , it is considered to have poor corporate governance, denoted as $CEOChair_{i,t}$.

2.1.4 Accounting conservatism

The empirical findings obtained after the robustness measurement method proposed by Khan and Watts (2009) is applied demonstrate that the CSCORE effectively captures variations in conditional conservatism. The CSCORE estimation concept introduced by Khan and Watts (2009) primarily addresses the limitations of the model proposed by Basu (1997), which is unable to facilitate cross-firm and cross-year

comparisons of conservatism. In this study, the CSCORE measurement is based on the model proposed by Basu (1997) for estimating conditional conservatism values for individual firms annually.

The higher a firm's CSCORE is, the greater its level of conditional conservatism is. The advantage of using the CSCORE method for assessing conditional conservatism lies not only in its ability to estimate individual firms' conditional conservatism on an annual basis but also in its empirical strength because it allows for a direct examination of the relationship between conservatism and the variables of interest in the study.

2.1.5 Control variables

This study incorporates control variables identified with reference to Chen et al. (2001) and Kim and Zhang (2016), including a negative conditional skewness coefficient ($NCSKEW_t$), stock turnover ($TURN_t$), firm-specific weekly return volatility ($SIGMA_t$), cumulative weekly returns ($CUMRET_t$), and firm size ($SIZE_t$). Additionally, the control variables include market-to-book ratio (MB_t), leverage ratio (LEV_t), operating performance (ROA_{t+1}), and earnings management (EM_t).

2.2 Empirical model

2.2.1 Model for testing Hypothesis 1

To test Hypothesis 1—whether higher (lower) CEO education levels are associated with lower (higher) corporate debt costs—this study employs the empirical model proposed by Khan and Watts (2009). The estimation equation is as follows:

$$DCFS_{i,t} = \alpha_0 + \alpha_1 CEOEDU_{i,t} + \sum_{q=2}^m \alpha_q (q^{th} ControlVar_{i,t}) + \varepsilon_{i,t} \quad (1)$$

where $CEOEDU_t$ represents the dummy variables for CEO education level, namely, $EDU-MP$, $EDU-M$, and $EDU-P$; $ControlVar_{i,t}$ represents the control variables; and $DCFS_t$ denotes the ratio of corporate bonds to total debt, which is used as an indicator of a company's debt cost. If $\alpha_1 < 0$, Hypothesis 1 is supported.

2.2.2 Model for testing Hypothesis 2

To test Hypothesis 2, this study divides the sample into two groups: companies in which the CEO does not concurrently serve as Chairman and companies in which the CEO does concurrently serve as Chairman (CEO Chair). The model from Equation (1)

is estimated separately for these two groups to compare the effect of CEO education level on corporate debt costs between the two groups.

2.2.3 Model for testing Hypothesis 3

For testing Hypothesis 3, the study first measures corporate accounting conservatism by using the CSCORE method, as outlined by Khan and Watts (2009). The firms are then divided into two groups on the basis of their level of accounting conservatism: firms with high accounting conservatism (CSCORE greater than the median) and firms with low accounting conservatism (CSCORE less than or equal to the median). The model from Equation (1) is again estimated separately for these two groups to compare the effect of CEO education level on corporate debt costs across different levels of accounting conservatism.

3. Empirical results

3.1.Descriptive statistics

Table 1 presents the descriptive statistics for all variables, with each variable calculated using annual data. The average and median DCFS are 0.1558 and 0.1246, respectively, indicating that 12.46%–15.58% of the debt structure of most companies comprises corporate bonds. The fact that the average DCFS is higher than the median suggests that a small number of companies have an unusually high proportion of corporate bonds. Regarding CEO education level, on average, 47.7% of CEOs hold a master's degree or higher (*EDU-MP*), with 39.5% holding a master's degree (*EDU-M*) and 8.1% holding a doctoral degree (*EDU-P*). The average CSCORE is -0.0833 , which is lower than the average CSCORE of 0.154 reported by Kim et al. (2016) that was based on data from the Center for Research in Security Prices and Compustat. This implies that the level of accounting conservatism in companies listed in Taiwan is relatively low.

Table 1: Descriptive statistics

Variables	Mean	S.D.	Q1	Median	Q3	# of samples
<i>DCFS_t</i>	0.1558	0.1285	0.0613	0.1246	0.2204	1,772
<i>EDU-MP_t</i>	0.4765	0.4995	0.0000	0.0000	1.0000	9,916
<i>EDU-M_t</i>	0.3952	0.4889	0.0000	0.0000	1.0000	9,916
<i>EDU-P_t</i>	0.0813	0.2733	0.0000	0.0000	0.0000	9,916
<i>CEO Chair_t</i>	0.3054	0.4606	0.0000	0.0000	1.0000	11,460
<i>CSCORE_t</i>	-0.0833	0.3805	-0.1219	-0.0435	0.0256	9,916
<i>NCSKEW_t</i>	-0.6755	0.8378	-1.1026	-0.5809	-0.1496	9,916
<i>TURN_t</i>	0.3180	19.9656	-4.2778	-0.2839	3.2598	9,916
<i>SIGMA_t</i>	4.5046	2.1521	2.9360	4.2020	5.7088	9,916
<i>CUMRET_t</i>	0.2087	0.6305	-0.1047	0.0632	0.3139	9,916
<i>SIZE_t</i>	16.0617	1.4185	15.0969	15.8697	16.8022	9,916
<i>MB_t</i>	1.6719	2.3638	0.8639	1.2740	1.9337	9,916
<i>LEV_t</i>	1.1501	4.6062	0.4305	0.7638	1.2601	9,916
<i>ROA_t</i>	0.0456	0.0901	0.0147	0.0433	0.0793	9,916
<i>EM_t</i>	0.0562	0.0714	0.0172	0.0382	0.0729	9,916

3.2 Results of testing Hypothesis 1

Table 2 illustrates the relationship between CEO education level and debt costs. The empirical results indicate that having a CEO with a master's degree or higher (*EDU-MP*) does not have a significant effect on a company's debt costs. Moreover, the coefficient for the correlation between CEOs with a doctoral degree (*EDU-P*) and *DCFS* is -0.0295 , which is significantly negative. This indicates that CEOs with a doctoral degree or specialized knowledge are more likely to apply their expertise in corporate decision-making, leading to a reduction in the company's debt costs.

Table 2: Relationship between education level and DCFS

Variables	<i>DCFS_t</i>		
	(1)	(2)	(3)
<i>EDU-MP_t</i>	0.0117		
<i>EDU-M_t</i>		0.0210***	
<i>EDU-P_t</i>			-0.0295**
<i>NCSKEW_t</i>	0.0008	0.0010	0.0006
<i>TURN_t</i>	0.0000	0.0000	0.0000
<i>SIGMA_t</i>	-0.0013	-0.0013	-0.0013
<i>CUMRET_t</i>	-0.0205***	-0.0205***	-0.0200***
<i>SIZE_t</i>	-0.0344***	-0.0351***	-0.0336***
<i>MB_t</i>	0.0062	0.0067*	0.0062
<i>LEV_t</i>	-0.0098***	-0.0099***	-0.0096***
<i>ROA_{t+1}</i>	0.0023	0.0019	0.0008
<i>EM_t</i>	-0.0231	-0.0195	-0.0260
Firm Fix Effect	Yes	Yes	Yes
Observations	1,576	1,576	1,576

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

3.3 Results of testing Hypothesis 2

Table 3 presents an analysis of the relationship between CEO education level and debt cost from the perspective of corporate governance, with DCFS used as an indicator. In companies with weaker corporate governance, where the CEO also serves as the Chairman (CEO Chair = 1), education level does not have a significant negative effect on debt cost. However, in companies with stronger corporate governance, where the CEO does not serve as the Chairman, the CEO having a doctoral degree (*EDU-P*) is significantly negatively correlated with DCFS. This suggests that in companies with better governance structures, CEOs having doctoral degrees can effectively reduce their company's debt costs.

Table 3: Relationship between education level and DCFS: CEO duality versus No CEO duality

Variables	CEO Chair = 1 (Poor governance quality)			CEO Chair=0		
	(1)	(2)	(3)	(1)	(2)	(3)
<i>EDU-MP_t</i>	0.0669**			0.0029		
<i>EDU-M_t</i>		0.0839***			0.0152*	
<i>EDU-P_t</i>			-0.0064			-0.0341**
<i>NCSKEW_t</i>	-0.0019	-0.0016	-0.0013	0.0025	0.0028	0.0024
<i>TURN_t</i>	-0.0004	-0.0004	-0.0004	0.0001	0.0001	0.0001
<i>SIGMA_t</i>	-0.0012	-0.0014	-0.0009	-0.0008	-0.0008	-0.0008
<i>CUMRET_t</i>	-0.0115	-0.0114	-0.0094	-0.0161***	-0.0164***	-0.0163***
<i>SIZE_t</i>	-0.0419***	-0.0450***	-0.0335**	-0.0355***	-0.0362***	-0.0344***
<i>MB_t</i>	0.0218**	0.0225**	0.0209**	-0.0042	-0.0034	-0.0036
<i>LEV_t</i>	-0.0102***	-0.0104***	-0.0095***	-0.0029	-0.0033	-0.0028
<i>ROA_{t+1}</i>	-0.3143***	-0.2985***	-0.3268***	0.0121	0.0121	0.0106
<i>EM_t</i>	-0.0184	-0.0212	-0.0121	-0.0185	-0.0137	-0.0162
Firm Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observation	507	507	507	1,068	1,068	1,068

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

3.4 Results of testing Hypothesis 3

Table 4 presents the results of an examination of the relationship between CEO education level and debt cost across companies classified according to their accounting conservatism (CSCORE). The analysis divides the sample into two groups on the basis of the median CSCORE: companies with more conservative accounting practices (CSCORE > median) and those with less conservative practices (CSCORE ≤ median). The results presented in Table 4 indicate that in companies with higher accounting conservatism, CEOs having a doctoral degree (*EDU-P*) is significantly negatively

correlated with DCFS, indicating that a CEO having a doctoral-level education helps reduce a company's debt costs. By contrast, in companies with lower accounting conservatism, no significant relationship is observed between CEO education level and debt costs.

Table 4: Relationship between CEO education level and DCFS: More versus less accounting conservatism

Variables	CSCORE > median (more conservative)			CSCORE ≤ median		
	(1)	(2)	(3)	(1)	(2)	(3)
$EDU-MP_t$	-0.0005			0.0124		
$EDU-M_t$		0.0156			0.0168	
$EDU-P_t$			-0.0482**			-0.0132
$NCSKEW_t$	-0.0001	-0.0001	-0.0004	-0.0046	-0.0044	-0.0046
$TURN_t$	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
$SIGMA_t$	-0.0019	-0.0020	-0.0018	-0.0034	-0.0034	-0.0033
$CUMRET_t$	-0.0234**	-0.0250**	-0.0241**	-0.0134*	-0.0128*	-0.0130*
$SIZE_t$	-0.0411***	-0.0422***	-0.0397***	-0.0279**	-0.0284**	-0.0283**
MB_t	0.0069	0.0079	0.0084	-0.0092	-0.0092	-0.0101
LEV_t	-0.0103***	-0.0106***	-0.0106***	-0.0028	-0.0025	-0.0024
ROA_{t+1}	0.0249	0.0251	0.0232	-0.0681	-0.0701	-0.0692
EM_t	-0.0749	-0.0705	-0.0788	0.0072	0.0125	0.0105
Firm Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	771	771	771	805	805	805

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

4. Conclusion

This study focuses on the influence of CEO education level on debt cost for companies listed in Taiwan and examines the moderating effects of CEO duality and accounting conservatism on the aforementioned relationship. The empirical results indicate that higher CEO education levels lead to lower company debt costs, demonstrating that highly educated CEOs are better equipped to apply their expertise in corporate decision-making and to navigate market fluctuations and uncertainties.

Furthermore, the influence of CEO education is more pronounced in companies with stronger corporate governance and accounting conservatism, producing a more pronounced reduction in debt costs.

The theoretical contributions of this study are twofold: 1) It highlights the driving effect of CEO education in the context of managerial heterogeneity, offering a new perspective for upper echelons theory. 2) It explores the mechanisms through which CEO education affects the cost of debt for listed companies, particularly from the perspectives of CEO duality and accounting conservatism, providing new insights into how CEO education influences corporate behavior. In terms of practical contributions, this study offers new evidence that can inform the decision-making process for CEO appointments and the selection of top executives in listed companies.

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The Influence of ESG on Firm Value and Overseas Development

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Abstract

This study examines the relation between firm's ESG rating and its value. Using Taiwanese data in the time spin of 2016 to 2024, we find the ESG rating doesn't associate with firm value proxies by Tobin's Q significantly. Further, this study identifies if pursuing overseas income drives the engagement of ESG activities under the concept of sustainable supply chain management. Empirical evidence shows the governance rating relates positively to and the environmental rating associates negatively with firm's overseas income. It is possible that the market rarely notices TEJ's ESG rating, or the rating couldn't reflect the true status quo about firm's ESG performance.

Keywords: ESG, firm value, overseas income, sustainable supply chain management

1. Introduction

Against the pressing societal concerns about environmental and social issues and the poor response of policymakers, firms informally entrust with the duty of addressing these challenges and integrate environmental, social and governance (ESG) into their business practices (Fiorillo et al., 2025).

Institutively, such integration increases firm's cost since those practices deviates from operation. The common sense suggests that the benefits of embracing ESG outweigh its burdens. From the income side, ESG increases consumer demand for "ethical" goods, strengthens the reputation of more socially responsible firms and, in turn, improves their financial performance (Servaes & Tamayo, 2013). From the cost side, as sustainability plays a greater role in investment decisions (Avramov, Cheng, Lioui, & Tarelli, 2022), financial markets may eventually reward these firms with tangible benefits. Numerous studies have examined the relationship between ESG ratings and firm market value, as well as the implications for investment returns. However, the findings remain largely mixed and inconclusive (Chau et al., 2025).

Eccles et al. (2014) demonstrate that high sustainability companies outperform low sustainability companies on both the market and accounting performance. Whereas, Pástor et al. (2021) show that brown stocks, which firms involve in industries with significant environmental harm, outperform green stocks, which represent shares of companies operating in environmentally friendly industries. Above empirical studies show no solid and consistent results. Moreover, Giglio et al. (2025) find investors' return expectations vary considerably across geographical regions due to different investors belief in ethic motives. Since Taiwan authority has promoted ESG for few years, it is about time to examine how the market reacts to ESG rating. The rationale behind is not only to see the impact from ESG performance but also to the accelerated push toward the ESG engagement.

Coming with the ESG, the concept of Sustainable Supply Chain Management (SSCM) also has emerged in response to growing public concern over environmental degradation and social challenges (Lien and Wang, 2025). SSCM integrates environmental, social, and economic considerations into traditional supply chain practices, aiming to minimize negative impacts while creating long-term value for all stakeholders. As sustainability becomes a fundamental expectation in global markets,

SSCM is increasingly recognized not only as an ethical responsibility but also as a strategic asset that enhances organizational resilience, innovation, and competitiveness. In this context, firms are increasingly collaborating to reconfigure their supply chains and drive collective ESG initiatives. By leveraging the combined resources, capabilities, and influence of supply chain partners, such collaborations seek to foster sustainable development and enable systemic improvements across environmental, social, and governance dimensions (Correia et al., 2024).

Taiwan's economy is highly export-oriented, with exports accounting for over 60% of its GDP. Within the framework of SSCM, it is anticipated that firms will actively invest in ESG initiatives to enhance their market competitiveness and capture emerging business opportunities. This trend is especially pronounced among companies with a strong reliance on international markets. Empirical studies by Tan et al. (2025) and Cai and Hao (2025) indicate that strong ESG performance is positively associated with increased overseas business income. Based on these findings, it is reasonable to expect that firms with higher ESG ratings will derive a greater proportion of their total revenue from overseas markets.

ESG is a conceptual indicator that combines Environment, Social, and Governance with different dimensions of assessment. Firms are unlikely to maintain balanced investment across the three ESG dimensions, and the impact of each dimension on firm tends to vary. For example, Fiorillo et al. (2025) examine how ESG performance affects the cost of debt in the primary corporate bond market and find lower yields (approximately 10 bps) for high-ESG firms, with results mainly attributed to the environmental and social pillars. Also, Darendeli et al. (2022) show that corporate social responsibility (CSR) supports firms in securing customer orders, particularly when corporate clients aim to maintain environmentally sustainable supply chains. That is, the three pillars of ESG have differing effects on firm value and overseas income. Therefore, assessing the impact of each ESG dimension individually is valuable, as it enables firms to prioritize one or two areas instead of all three, especially when addressing specific strategic concerns.

The purpose of this study is threefold. First, it examines how the market reacts to ESG ratings using data from the emerging Taiwanese market. Second, it investigates the relationship between ESG ratings and firms' foreign income in the context of an

export-driven economy. Third, it decomposes the overall ESG rating into its three constituent dimensions—environmental, social, and governance—to identify their individual effects. Utilizing data from Taiwanese firms spanning 2016 to 2024, this study aims to provide insights into the distinct roles of each ESG dimension in shaping firm performance.

2. Literature review and hypotheses development

2.1 ESG

Environmental, Social, and Governance (ESG) practices were initially introduced through a 2004 United Nations initiative and gained global recognition with the launch of the Principles for Responsible Investment (PRI) in 2006, has become a key corporate strategy focused on sustainability (Hou et al., 2025; Yi et al., 2024; Chen et al., 2025). Adeneye, et al. (2023) also document that ESG has been a surge of interest in non-financial performance, particularly corporate sustainability and the integration of ESG factors after the Paris Agreement on climate change in 2015. Numerous national policies have driven widespread adoption of ESG practices (Zhou et al., 2020).

Environmental, Social and Governance factors are a critical input in emerging markets for managing risks, attracting capital, being competitive, and complying with evolving regulations (Rahat and Nguyen, 2024). The increasing significance of ESG factors marks a crucial transformation in how businesses are valued by investors, stakeholders, and the wider public. Rahat and Nguyen (2024) document that a growing recognition of the intricate relationship between corporate behavior, societal impact, and long-term financial performance has prompted an increased emphasis on ESG considerations. As this recognition gradually matures, companies have no choice but to invest in ESG activities. Prior literature also show that firms with robust ESG practices are perceived as better equipped to navigate a dynamic business environment, encompassing regulatory shifts (Mirza, et al., 2023), climate-related challenges (Shan, et al., 2023), and social disruptions (Becchetti, et al., 2023). Investing in ESG activities seems to be another non-core operational activity of enterprises.

In this social cognitive atmosphere, engaging in ESG generates competitive advantage (Wang et al., 2023). As consumers become more environmentally and socially conscious, companies with stronger ESG profiles gain a competitive edge

(Xiao, et al., 2024). This can result in an increased market share and revenue growth, further positively influencing the company's valuation. Further, ESG compliance is indicative of a company's long-term focus. Investors seeking stable and resilient investments view ESG-compliant companies favorably (Lian, Ye, Zhang, & Zhang, 2023). The commitment to sustainable practices contributes to long-term financial performance, supporting a positive valuation outlook (Rahat and Nguyen, 2024).

When incorporating ESG factors into investment decisions, it is essential for firms to also consider the expected return. Companies with strong ESG performance often benefit from improved access to financing (Su et al., 2024), which enhances their ability to invest in growth and strategic initiatives, thereby positively influencing their valuation (Ferriani, 2023; Rojo-Suárez & Alonso-Conde, 2023). Additionally, a solid ESG profile strengthens a company's reputation and brand image (Lee et al., 2022). Firms perceived as socially responsible and environmentally conscious tend to attract more customers, business partners, and investors. This favorable perception can translate into a higher market valuation, as stakeholders increasingly associate ethical and sustainable practices with long-term value creation (Rahat & Nguyen, 2024). Existing literature suggests that ESG practices can enhance financial performance (Fatemi et al., 2015; Albuquerque et al., 2019) and improve operational stability and market resilience (Lins et al., 2017). The above results make companies willing to continue investing in ESG.

Benefit from ESG investment also yields to the others. Existing literature suggests that ESG practices contribute to lowering financing costs, increasing access to external financing, and greater transparency in their governance structures (Chen et al., 2025). Strong ESG performance can reduce risk perceptions among investors and creditors, thereby lowering external financing costs (Chen et al., 2023; Dhaliwal et al., 2011). Furthermore, ESG is also linked to green innovation (Lin et al., 2021; Wang et al., 2023), better risk management and governance, lowering the risk perceptions of investors and creditors (Lian et al., 2023), boosts corporate reputation and market recognition, mitigating the adverse effects of information asymmetry (Eccles et al., 2014). In sum, strong ESG performance enables firms to secure external financial support more easily (Cheng et al., 2014).

2.2 ESG and firm market value

Existing literature suggests that ESG practices can enhance financial performance and improve operational stability and market resilience (e.g., Chen et al., 2025). This is also true in emerging market (Rahat and Nguyen, 2024). However, Duque-Grisales & Aguilera-Caracuel (2019) find a negative correlation between ESG and corporate performance in emerging markets. Cai and Hao (2025) present two contrasting perspectives on the relationship between ESG and corporate performance. One view suggests that ESG practices enhance a company's competitiveness, innovation capacity, and commitment to social responsibility, thereby fostering stakeholder trust and brand reputation—factors that become critical drivers of business success, especially in challenging times. In contrast, the opposing view argues that ESG efforts can lead to inefficient resource allocation, information asymmetry, and greater exposure to risks, ultimately reducing a firm's overall value.

H1: There is a positive relation between ESG rating and firm market value in Taiwan.

2.3 ESG and overseas income

The positive relation stands base on the stakeholder theory where firms enhance legitimacy by aligning with stakeholder expectations. Contrarily, the negative relation between ESG performance and firm market value is supported by the agency theory which argues a negative association due to potential conflicts of interest between managers and shareholders. Essentially, Taiwan is a small economic entity and depends heavily on international trade. It is more likely that Taiwanese firms engage in ESG due to stakeholder expectation since they are actively participating in international supply chain activities and facing significant pressure in their export strategies. Compliance with ESG protocols can bring more business opportunities as well as overseas income to Taiwan's foundry manufacturers.

For Taiwan, which is heavily dependent on trade, the argument that compliance with ESG agreements can bring more benefits is supported. Tan et al. (2025) find superior ESG performance significantly enhancing overseas business income using Chinese A-share listed samples. They suggest that strong ESG performance can convey non-financial information, reduce information barriers, and increase overseas business income, and that it fosters overseas business income by mitigating financing constraints, circumventing operational risks, and bolstering product competitiveness. Moreover, Cai and Hao (2025) use Chinese-listed companies from 2009 to 2015 and

find ESG performance has a substantial positive effect on export performance, with financing cost reduction and alleviation of financial constraints being key mechanisms, particularly through green technology innovation. As a result, we develop our first hypothesis as:

H2: There is a positive relation between ESG rating and overseas income in Taiwan.

3. Data and methodology

To understand whether Taiwanese firms engaging in ESG activities relates to their foreign sales and market value due to the international code on ESG, this study collects Taiwan public firm data including all of the financial data and ESG rating from Taiwan Economic Journal (TEJ). About 2,449 firms are obtained in the time span of 2016 to 2024 from either the Taiwan Stock Exchange Corporation or the Taipei Exchange.

The TESG Rating is the first ESG indicator in Taiwan authorized by Sustainability Accounting Standards Board. It is a quantitative assessment of the ESG performance of publicly listed and publicly issued companies. The assessment uses over 60 variables across 16 issues related to the three pillars of ESG (Environmental, Social, and Governance). It provides comprehensive ESG ratings for Taiwan's publicly listed companies. Using over 70 quantitative variables and covering 16 sustainability topics, TESG ratings represent not only companies' achievements in ESG (Environmental, Social, and Governance) but also serve as a crucial reference for investors and financial institutions evaluating future potential. Therefore, this study collects the TESG and also the ratings of Environment, Social, and Governance (Escore, Sscore, and Gscore) from TEJ.

Rahat and Nguyen (2024) and Chau et al. (2025) investigate the impact of ESG scores on firm valuation, using Tobin's Q as valuation metrics. Rahat and Nguyen (2024) argue the Tobin's Q assesses the alignment between a company's market value and the replacement cost of its assets, valuable for evaluating operational efficiency and market pricing. This study uses equation (1) to test the relation between firm's ESG performance and its market value in our panel regression fixed effect model.

$$y_{i,t} = \alpha_0 + \beta_1 ESG_{i,t} + \beta_2 Control_{i,t} + YE + FE + \varepsilon_{i,t} \quad (1)$$

The control variables include firm size (*Lsize*), market-to-book ratio (*MB*), R&D expense (*RD*), leverage (*LEV*), Asset turnover (*Asset_T*), Turnover (*Turn*), Cash ratio

(*Cash_R*), and earnings per share (*EPS*). The *Lsize* is the natural logarithm of firm's total asset. *MB* is the market to book ratio. *RD* is the RD expenses divided by total asset. Following Chau et al. (2025), the *Asset_T* is the net income divided by total asset and *LEV* is the total asset divided by share capital. *Turn* is the annual trading volume divided by the number of shares outstanding. *Cash_R* is the cash flow ratio, measured whether the cash flow generated by business activities is sufficient to pay current liabilities under normal operation. All the variables are measured on annual basis.

To understand if the ESG performance is driven by firm's oversea business, this study developed the equation (2) as:

$$Osales_{i,t} = \alpha_0 + \beta_1 ESG_{i,t} + \beta_2 Control_{i,t} + YE + FE + \varepsilon_{i,t} \quad (2)$$

The *Osales* is the ratio of foreign sales to domestic sales. The Financial Supervisory Commission no longer asks firms to report the data since 2024, we access the *Osales* from 2016 to 2023. Again, we use four ESG indicators in equation (2). As to the control variables, we include the return-on-asset (ROA), the sales growth rate (SG) that measures the change in a company's sales compared to that in previous year. Due to the foreign directors on board affects the intention of foreign sales, we include the ODR computed as the number of foreign directors to the board size in equation (2).

4. Empirical results

The descriptive statistics is showed in Table 1. All the variables are reported in prior chapter. About 2,449 firms are obtained in the time spin of 2016 to 2024 from either the Taiwan Stock Exchange Corporation or the Taipei Exchange and finally 14,990 firm-year data are collected.

Among those ESG indicators, *TESG* is the comprehensive, overall measurement indicator with a mean of 54.7 and median of 54. Also, the means for *Escore*, *Sscore*, and *Gscore* are 55.02, 54.73, and 55.02. All of the four indicators have similar value. Seems like most of the performance assessments to firms are valued at an ordinary level, rarely having outstanding performances. This phenomenon is normal for a newly established evaluation agency. Under the pressure of reducing negative reactions from the evaluated, many evaluations try to adopt neutral evaluations. At the same time, they also try not to give negative comments from the perspective of encouraging the evaluated. The correlations are reported in Table 2.

Table 1
Descriptive statistics

This table reports the descriptive statistics of all variables used in this study. The data is collected from the TEJ in the time spin of 2016 to 2024 on annual basis. About 2249 firms are obtained. The definition of the variables are reported in the text.

	Lnsiz	MB	ROA	RD	LEV	TURN	EPS
Mean	15.4470	2.3207	4.1945	29.4266	5.7893	199.265	3.0675
Median	15.2731	1.65	4.38	13.8739	4.0095	81.3818	1.61
Maximum	22.6242	203.68	89.31	707.524	162.231	5858.673	210.70
Minimum	9.7566	0.19	-127.50	0	0.0145	0.5160	-35.39
Std. Dev.	1.4881	3.5789	9.1793	47.3897	7.7717	331.237	7.4019
	Cash_R	ASSET_T	ASSET_G	DEBT_R	Return	TBQ	TESG
Mean	1.2603	0.7334	7.7621	0.4077	18.0317	1.4157	54.7033
Median	0.59	0.6552	3.56	0.4087	6.81	1.06	54
Maximum	173.18	5.7049	777.15	0.9976	993.69	56.18	83.7300
Minimum	0.00	0	-82.15	0.0048	-85.29	0.02	29
Std. Dev.	4.333	0.5150	27.6018	0.1767	53.6446	1.5327	8.3540
	Escore	Sscore	Gscore	ODR	Osales	SG	FCFTA
Mean	55.0231	54.7319	54.5409	0.0161	0.6229	11.9736	1.2603
Median	52.92	53.82	55.02	0	0.7425	2.4350	0.5940
Maximum	92.16	91.00	84.41	0.9091	1	11765.7	173.184
Minimum	23.32	26.58	19.65	0	-0.0480	-99.270	0.0011
Std. Dev.	12.2089	10.9718	10.5096	0.0693	0.3418	182.441	4.3330

Table 2
Correlation Coefficient

This table reports the correlation coefficient of variables. The definitions of all variables are the same as in Table 1. Values in boldface are significant at the 10% or higher level.

	Lnsiz	MB	ROA	RD	LEV	TURN	EPS	Cash_R	ASSET_T	ASSET_G	DEBT_R	Return	TBQ	TESG	Escore	Sscore	Gscore	ODR	Osales	SG
MB	0.0628																			
ROA	0.2112	0.1044																		
RD	0.1473	0.1736	0.0177																	
LEV	0.4613	0.0378	0.1741	0.0269																
TURN	0.0333	0.1189	0.1919	0.1652	0.0279															
EPS	0.2865	0.1579	0.5235	0.0552	0.5876	0.1077														
CASH_R	0.1354	0.0374	0.0048	0.0870	0.0180	0.0003	0.0105													
ASSET_T	0.0691	0.0281	0.2192	0.0256	0.0411	0.0615	0.1154	-0.1689												
ASSET_G	0.0543	0.1195	0.2751	0.0170	0.1125	0.1589	0.1736	0.1039	-0.0016											
DEBT_R	0.2806	0.0395	0.1711	0.1802	0.2098	0.0091	0.0692	-0.3696	0.2135	0.0549										
Return	0.0348	0.2099	0.2235	0.0360	0.0262	0.4078	0.1249	0.0053	0.0512	0.2644	0.0006									
TBQ	0.1061	0.6100	0.2066	0.2974	0.0123	0.1754	0.2367	0.1290	-0.0136	0.1160	-0.1925	0.2676								

TESG	0.4673	0.0236	0.1915	0.0664	0.1975	0.0223	0.1934	-0.0567	0.1280	-0.0045	0.0430	0.0215	0.0468							
Escore	0.4477	0.0135	0.1169	0.0082	0.1926	0.0248	0.1460	-0.0737	0.1124	-0.0112	0.1189	0.0114	0.0002	0.7505						
Sscore	0.4885	0.0138	0.1397	0.0562	0.1561	0.0147	0.1379	-0.0564	0.0654	0.0011	0.0523	0.0143	0.0327	0.7794	0.5214					
Gscore	0.1589	0.0259	0.1601	0.0671	0.1147	0.0127	0.1506	-0.0064	0.1174	-0.0041	-0.0470	0.0207	0.0616	0.6972	0.2661	0.2296				
ODR	0.0415	0.0696	0.0004	0.0381	0.0266	0.0002	0.0422	0.0125	0.0156	-0.0107	0.0142	0.0037	0.0258	0.0446	0.0233	0.0076	0.0693			
Osales	0.0665	0.0005	0.0211	0.1890	0.0461	0.1139	0.0834	-0.0039	0.1030	-0.0002	0.0324	0.0170	0.0031	0.0104	0.0620	0.0460	0.0148	0.0037		
SG	0.0110	0.0403	0.0241	0.0147	0.0006	0.0275	0.0139	0.0123	-0.0017	0.2277	0.0172	0.0739	0.0542	0.0200	0.0203	0.0137	-0.0125	0.0108	0.0099	
FCFTA	0.0881	0.0527	0.3412	0.0251	0.0572	0.0241	0.1771	-0.0876	0.1267	-0.2513	-0.1051	0.0548	0.0333	0.1201	0.0711	0.0840	0.1122	0.0021	0.0080	-0.0344

To test the hypothesis 1, this study uses the panel regression with fixed year effect and firm effect to identify if the ESG performance matters to firm value. The result is reported in Table 3. Four ESG indicators are applied as the dependent variable. Among them, the *TESG* associates insignificantly with firm value showing the ESG performance doesn't matter much to firm performance. When three pillars of ESG are tested separately, only *Escore* displays a significant relation with the Tobin's Q. The empirical results support the argument of Chau et al. (2025) that relation between ESG and firm value remains largely mixed and inconclusive.

Even literatures argue a positive relation between ESG performance and firm value, some issues need to be further clarified. First, is the ESG assessment mechanism correct and the measurement truly reflects the status quo of firm's performance? When it comes to evaluation, the fairness and authority of the evaluation unit are often examined. Even the TEJ is the only one institution that offers ESG performance of public firms in Taiwan, their measurement might not be accepted by all of the market participants. That is, when the market questions the accuracy of such information, it will not react to it. Second, the TEJ is a closed database. Users must pay to access the data. Therefore, when there are obstacles to obtaining information and the trust is not high, this may also be the reason why the research results are not significant. Finally, judging from the numerical distribution of the rating data, most of the rated companies are clustered at 54 points, indicating that the agency may have considered avoiding negative emotions from the rated or encouraging the rated companies to pursue improvement, which made the ESG rating scores overly concentrated, causing problems in data analysis.

The hypothesis 2 argues the overseas business drives the intention of ESG engagement in Taiwan. The *Osales* is used as the dependent variable that measures the degree of overseas sales to firm's overall sales in the year. The higher *Osales* represents the firm depending more on the international business. This study tests if the *TESG* and *Escore* relating positively to the *Osales*. Staying with the concept of Sustainable Supply Chain Management, firms are expected to engage in ESG for obtaining business opportunity. Table 4 reports the results.

Surprisingly, the *TESG* is not found to have a statistical relation with *Osales*. Nevertheless, the *Escore* associates negatively with *Osales*. The results tell the ESG engagement doesn't affect firms' overseas business, suggesting the sustainable supply

chain management might not sound in Taiwan or the ESG assessment by TEJ might be questionable.

Table 3
Regression analysis on the ESG to Tobin's Q

This table reports the panel regression analysis with year and firm fixed effect to test the relation between ESG performance and firm value. The Tobin's Q is the dependent variable that represents the firm value. All the variables are defined as same as those in Table 1.

	Tobin's Q			
<i>TESG</i>	0.0013 (0.4559)			
<i>Escore</i>		0.0025 ** (0.0157)		
<i>Sscore</i>			5.72E-06 (0.9967)	
<i>Gscore</i>				-4.87E-05 (0.9630)
<i>Lnsize</i>	-0.1595 ** * (0.0000)	-0.1627 ** * (0.0000)	-0.1567 ** * (0.0000)	-0.1566 ** * (0.0000)
<i>MB</i>	0.1487 ** * (0.0000)	0.1487 ** * (0.0000)	0.1487 ** * (0.0000)	0.1487 ** * (0.0000)
<i>RD</i>	0.0039 ** * (0.0000)	0.0039 ** * (0.0000)	0.0039 ** * (0.0000)	0.0039 ** * (0.0000)
<i>LEV</i>	-0.0326 ** * (0.0000)	-0.0331 ** * (0.0000)	-0.0325 ** * (0.0000)	-0.0325 ** * (0.0000)
<i>Asset_T</i>	0.1131 ** * (0.0023)	0.1091 ** * (0.0033)	0.1145 ** * (0.0020)	0.1146 ** * (0.0020)
<i>Turn</i>	0.0005 ** * (0.0000)	0.0005 ** * (0.0000)	0.0005 ** * (0.0000)	0.0005 ** * (0.0000)

	(0.0000)	(0.0000)	(0.0000)	(0.0000)
<i>Cash_R</i>	0.0050 **	0.0050 **	0.0050 **	0.0050 **
	(0.0171)	(0.0187)	(0.0172)	(0.0173)
<i>EPS</i>	0.0377 ** *	0.0376 ** *	0.0377 ** *	0.0377 ** *
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Year Effect	YES	YES	YES	YES
Firm Effect	YES	YES	YES	YES
Obs.	14490	14490	14490	14490
Adj. R ²	0.7406	0.7407	0.7406	0.7406
F-statistic	23.8970 ** *	23.9099 ** *	23.8957 ** *	23.8957 ** *
P(F-statistic)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table 4

Regression result on the ESG performance and firm's overseas sales

This table reports the panel regression analysis with year and firm fixed effect to test the relation between firm's overseas income proportion and its ESG performance.

All the variables are defined as same as those in Table 1.

	<i>Osales</i>			
<i>TESG</i>	0.0002 (0.3425)			
<i>Escore</i>		-0.0003 * (0.0786)		
<i>Sscore</i>			0.0001 (0.5025)	
<i>Gscore</i>				0.0003 ** (0.0173)
<i>Lsize</i>	0.0283 *** (0.0000)	0.0299 *** (0.0000)	0.0286 *** (0.0000)	0.0282 *** (0.0000)
<i>ROA</i>	-0.0002 (0.1367)	-0.0003 (0.1182)	-0.0002 (0.1332)	-0.0002 (0.1417)
<i>RD</i>	2.5E-05 (0.6973)	2.9E-05 (0.6402)	2.5E-05 (0.6955)	2.6E-05 (0.6807)
<i>Asset_T</i>	0.0438 *** (0.0000)	0.0448 *** (0.0000)	0.0440 *** (0.0000)	0.0438 *** (0.0000)
<i>SG</i>	1.2E-05 ** (0.0298)	1.1E-05 ** (0.0373)	1.2E-05 ** (0.0322)	1.2E-05 ** (0.0260)
<i>ODR</i>	0.0768 ** (0.0345)	0.0748 ** (0.0394)	0.0766 ** (0.0349)	0.0763 ** (0.0356)
Year Effect	YES	YES	YES	YES
Firm Effect	YES	YES	YES	YES
Obs.	11075	11075	11075	11075

Adj. R ²	0.9278	0.9278	0.9278	0.9279
F-statistic	91.3936 ***	91.4164 ***	91.3897 ***	91.4425 ***
P(F-statistic)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

5. Conclusion

This study reexamines the relation between firm's market value and ESG performance in Taiwan in the absence of a solid conclusion on this issue. Empirical results show no clear relation between firm's value and its ESG performance even in the cases of separating the three pillars from the whole. This study consists with the argument of Chau et al. (2025) that findings remain largely mixed and inconclusive.

Based on the concept of sustainability supply chain management, this study argues the Taiwanese firms that depends heavily on exports should weight much on ESG performance for pursuing oversea income. The results show insignificant relation between ESG performance and firm's oversea business share, suggesting the sustainability supply chain management doesn't stand in Taiwan.

This study essentially not only identifies whether the market reacts positively to the ESG performance as suggested by literatures or the stand of sustainability supply chain management, it also explores issues about TEJ's assessment of ESG performance. One obvious problem is that TEJ may have taken the position of encouraging enterprises when conducting the evaluation, and the scores evaluated have a clustering phenomenon and fail to have a differentiated comparison effect. Another possible issue is that the rating results are closed information that is not freely available to the public. When the market cannot easily obtain them, they fail to fully reflect the ESG performance of the companies. In fact, some Taiwanese companies use other methods other than TEJ ratings to highlight their ESG, environmental, or sustainability performance. That probably explains why the ESG or environmental performance is incapable of describing firm's oversea business. This study provides a consideration on the use of ESG rating data.

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The Two Faces of the Crowd: Herding Behavior in Retail Margin Trading

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Abstract

This study investigates the herding behavior of retail margin traders in the Taiwanese stock market from 2018 to 2021. By analyzing intraday data from the Taiwan Stock Exchange, we measure the herding tendencies in both margin buying and short selling among retail investors, comparing them to non-margin traders. The research explores how this herding varies across firms with different characteristics and its correlation with future stock returns to identify influencing factors. As the first study to link margin trading with herding effects, this research aims to fill a gap in the existing literature and enrich the understanding of retail investor behavior in margin trading.

Keywords: *Margin Trading , Margin Purchase , Short Selling , Herding Behavior*

1. Introduction

Margin trading, which includes margin buying and short selling, plays a key role in modern securities markets. In theory, margin trading helps integrate and transmit market information, thereby affecting price efficiency and volatility (Diamond and Verrecchia, 1987; Seguin, 1990). Many empirical studies on emerging markets also support this view, finding that the introduction of margin trading can promote price discovery and reduce market volatility (eg, Chang et al., 2014; Chen et al., 2016; Li et al., 2018; Gao and Ding, 2019). However, most of the existing literature focuses on the overall effect of margin trading, or mainly explores the behavior of institutional legal persons (Boehmer et al., 2008), and relatively little attention is paid to the motivation and impact of retail investors participating in margin trading. A core question is: when retail investors use credit trading, are their behaviors more speculative than ordinary transactions, or do they become more cautious and more informed because of the high leverage risks and costs involved?

Previous literature has provided different insights into the two aspects of credit trading. In terms of short selling, due to the restrictions and costs of short selling, the theory expects that short sellers should have superior information to make profits (Diamond and Verrecchia, 1988). A large number of empirical studies support this argument, finding that short selling by institutional investors can predict future negative events (eg, Boehmer et al., 2008; Christophe, Ferri and Hsieh, 2009; Karpoff and Lou, 2010). Interestingly, even retail investors, who are traditionally regarded as noise traders, have been shown to have information value in their short selling behavior, which can predict future negative returns (Gamble and Xu, 2013; Kelley and Tetlock, 2017). Nevertheless, short sellers may also exhibit behavioral biases such as the disposition effect (Beschwitz and Massa, 2020).

In contrast, research on margin buying (leveraged trading) generally finds that it is highly correlated with behavioral biases. Overconfidence is considered to be the main reason that drives retail investors to use margin trading. These investors trade more frequently and are more speculative, but have poor stock selection skills (Barber, Huang, Ko and Odean, 2020; Kim, Kim and Hanna, 2022). In addition, margin trading may exacerbate the disposal effect of retail investors and lead to deteriorating performance (Heimer and Imas, 2022). Some models also point out that margin requirements distort the distribution of rewards, making them similar to lottery stocks,

suggesting that retail investors' financing behavior may be driven by motivations such as seeking excitement or entertainment (Ladley, Liu and Rockey, 2016).

To gain a deeper understanding of the behavioral patterns of retail credit trading, this study introduces the perspective of herding behavior. Herding means that investors tend to imitate others and trade in the same direction. Its driving factors can be divided into information-driven and behavior-driven (Bikhchandani and Sharma, 2001; Kremer, 2010). Information-driven herding may originate from similar private information (Hirshleifer, Subrahmanyam and Titman, 1994) or analytical framework (Falkenstein, 1996); behavior-driven herding involves imitating others' decisions (which may lead to information waterfalls, Bikhchandani, Hirshleifer and Welch, 1992) or following the market mainstream based on reputation considerations (Scharfstein and Stein, 1990).

Previous studies have confirmed that both institutional and retail investors have clustering in their general transactions (eg, Lakonishok et al., 1992; Wermers, 1999; Barber et al., 2009b), and its driving factors can be inferred by analyzing the conditions under which it occurs and the impact on subsequent stock prices (eg, Puckett and Yan, 2008; Hsieh, 2013). However, most clustering studies focus on spot trading, and rarely explore the clustering behavior of credit traders. Only Lin and Lin (2014) have measured the overall margin trading clustering in the Taiwan market, but the overall level indicators they used cannot distinguish between individual stocks. This research gap means that we still lack sufficient understanding of why credit traders cluster and trade.

This study aims to fill this gap and systematically examine the herding behavior in retail credit trading for the first time. We use the Taiwan securities market as a unique research field, as retail investors have long played an important role in credit trading, providing an ideal natural experimental environment. The main objectives of this study are twofold: first, to verify whether there is a herding effect in retail credit trading and compare it with non-credit trading. Second, to explore the potential motivations driving retail credit trading herding. To this end, we will examine how the herding tendency changes under different company characteristics and analyze its association with future stock price returns.

We use the intraday trading data of listed companies from 2018 to 2021 on the Taiwan Stock Exchange to calculate the daily clustering indicators of retail investors'

margin buying and short selling. Preliminary analysis shows that the average clustering degree of credit trading is indeed higher than that of general retail transactions. By analyzing the relationship between herding behavior and company characteristics and future returns, we hope to clarify whether the factors that drive retail investors to engage in margin trading and short selling are information considerations, behavioral biases, or both. Overall, this study, by linking the two major topics of credit trading and herding behavior, can not only enrich the discussion of the literature on the clustering effect, but also provide new empirical evidence for understanding retail credit trading behavior.

2. Data and Methodology

2.1 Research hypothesis

This study explores the clustering effect of retail credit traders. Lin and Lin (2014) measured the clustering effect of overall credit traders using data from the Taiwan market and found that the clustering effect of margin trading and short selling existed, but there was no difference in the clustering effect between margin trading and non-credit trading retail traders. According to the literature on credit trader behavior, it is believed that the factors driving and influencing margin buying and short selling are different. Gamble and Xu (2013) and Kelley and Tetlock (2014) proved that retail investors' short selling is more likely to be information trading than general retail investors, and can correctly predict future negative returns ; and according to Zhou and Lai (2009) , the higher the probability of information trading, the higher the clustering tendency, because information traders may make the same trading decisions based on their information; on the contrary, the literature found that retail investors' margin buying is affected by behavioral biases such as overconfidence and disposition effect (eg Barber, Huang, Ko and Odean , 2020; Kim, Kim and Hanna, 2022) , indicating that retail investors' margin buying may be more susceptible to the influence of others to trade. According to the inference of past literature, although the driving factors behind short selling and margin buying may be different, they should have a more obvious clustering tendency than general retail investors. Based on this, hypothesis 1 is established.

Hypothesis 1: There is clustering behavior in both margin buying and short selling transactions by Taiwan's retail investors.

The herding effect of investors may have different manifestations in different types of stocks. Lakonishok, et al. (1992) and Shyu and Sun (2010) believe that legal persons have a higher herding phenomenon in stocks with less information circulation, such as small companies and companies with low liquidity, which is more in line with the hypothesis of information waterfall; Ladley, Liu and Rockey (2016) found that the demand for margin trading distorts the originally symmetrical reward distribution into a positive skewness similar to lottery stocks. Retail investors' leveraged trading is driven by entertainment behavior bias. Based on this, it is inferred that the herding effect of margin buying may be more obvious in lottery stocks. On the other hand, according to Zhou and Lai (2009), the higher the probability of information trading, the higher the herding tendency of legal persons. Past literature has mostly supported that short selling is more likely to have information, so the herding effect of short selling investors should be more obvious in stocks with a high probability of information trading. Based on this, Hypothesis 2 is established.

Hypothesis 2: The clustering effect of margin buying and short selling by Taiwanese retail investors will vary depending on the characteristics of different stocks.

Stock price performance before and after the occurrence of the herd effect is also a focus of discussion in the literature. Lin and Lin (2014) found that the herd effect of margin trading and short selling is affected by previous returns, and tends to sell (buy) stocks that have fallen (risen) in the past when the market falls (rises) sharply. The impact on subsequent stock prices after the herd effect occurs is more important, and the literature often uses this as a basis for judging the trading motivation of the herd effect actor. Barber et al. (2009b) found that retail investors' herd trading has a short-term impact on stock prices, but the price reverses after about 3 to 4 weeks; Hsieh (2013) also found that stock prices will reverse significantly after retail investors' herd trading, and the stock price will have negative (positive) returns after the buyer (seller) herd trading, so it is inferred that retail investors' trading is more likely to be behavior-driven. On the other hand, in the literature on credit trading, some believe that opening credit trading channels can promote stock price efficiency, and there are also literatures that support that short selling transactions are informative (e.g. Boehmer, et al., 2008; Christophe, Ferri and Hsieh, 2009; Karpoff and Lou, 2010; Gamble and Xu, 2013; Kelley and Tetlock, 2014, etc.). Therefore, after the short selling transactions cluster,

there should be a significant price drop; on the contrary, recent literature believes that retail investors who engage in margin buying are driven by behavioral factors. Therefore, this project infers that after the margin buying transactions cluster, there will be a price reversal in the short term, which means that the impact of its transactions on stock price returns is short-term. Based on this, Hypothesis 3 is established .

Hypothesis 3: The clustering effects of margin buying and short selling by Taiwanese retail investors have different impacts on subsequent stock price returns.

2.2 Sample selection and data sources

This study uses the daily data of listed companies on the Taiwan Stock Exchange from January 2018 to December 2021 as a sample. During this period, it experienced major financial market shocks such as the epidemic , the Ukrainian-Russian war, and inflation. It can observe the differences in retail credit trading clustering behavior between normal markets and high-risk markets . This paper first measures the clustering index of credit transactions. It uses the intraday transaction transaction files and entrustment files provided by the stock exchange to calculate the number of daily margin purchases and short sales to calculate the clustering index. Other company characteristics and stock price data, such as size, volatility, liquidity, stock price returns, etc., are taken from the Taiwan Economic Times (TEJ) database.

2.3 Empirical design

This study first uses intraday data from the Taiwan Stock Exchange to measure the clustering indicators of retail margin buying and short selling transactions, and then observes the relationship between credit traders' clustering behavior and company characteristics and stock price returns.

2.3.1 Measurement of clustering indicators

In the literature, there are indicators for measuring the clustering effect. In the early stage, there are indicators such as Christie and Huang (1995) CSSD (Cross-Sectional Standard Deviation of Return) , which uses the dispersion of cross-sectional stock returns to measure clustering behavior and test whether there is a special concentration during market extreme periods ; and Chang, Cheng and Khorana (2000) CSAD (Cross-Sectional Absolute Standard Deviation) , which also uses cross-sectional stock returns to explore the sensitivity to changes in the overall market return rate .

Both indicators can only measure the clustering tendency of the overall market. This project aims to measure the clustering effect of individual stocks and will use Lakonishok et al. (1992) method, observe whether investors tend to concentrate on buyers or sellers in a specific period of time, compared with the overall market's buying and selling ratio for a specific stock; to avoid the impact of large orders, the change in holdings will be modified to the number of orders according to Zhou and Lai (2009) . The detailed method of clustering measurement is as follows:

$$HM_{it}^{MB} = \left| PB_{it}^{MB} - E \left[PB_{it}^{MB} \right] \right| - E \left[\left| PB_{it}^{MB} - E \left[PB_{it}^{MB} \right] \right| \right] \quad (1)$$

$$HM_{it}^{SS} = \left| PB_{it}^{SS} - E \left[PB_{it}^{SS} \right] \right| - E \left[\left| PB_{it}^{SS} - E \left[PB_{it}^{SS} \right] \right| \right] \quad (2)$$

HM_{it}^{MB} and HM_{it}^{SS} are the financing transaction cluster and short selling transaction cluster, respectively. is PB_{it}^k the purchase ratio of financing transaction investors to stock i on day t (, where k is financing transaction (MS) and short selling transaction (SS), respectively, BUY_{it}^k () $SELL_{it}^k$ is the number of purchases (sales) of stock i by investors of type k on day t); $E \left[PB_{it}^k \right]$ is the expected value of assuming that investors have no herd behavior on stock PB_{it}^k i , measured by the number of purchases of this type of investors in the entire market on day t divided by the total number of purchases and sales.

$E \left[\left| PB_{it}^k - E \left[PB_{it}^k \right] \right| \right]$ It is the adjustment factor of the herd indicator. This factor can adjust the scale difference caused by the different number of transactions. Its meaning is the expected value calculated by random probability distribution under the null hypothesis of no herd behavior. Since there are only two stock investment operations, buying and selling, the adjustment factor is calculated by binomial distribution:

$$E \left[\left| PB_{it}^k - E \left[PB_{it}^k \right] \right| \right] = \sum_{\theta=0}^{n_{it}^k} \left| \frac{\theta}{n_{it}^k} - E \left[PB_{it}^k \right] \right| C_{\theta}^{n_{it}^k} (E \left[PB_{it}^k \right])^{\theta} (1 - E \left[PB_{it}^k \right])^{n_{it}^k - \theta} \quad (3)$$

This study compares the difference in clustering effect between credit trading investors and general retail investors, and calculates the clustering value (HM_{it}^{INDI}) of general non-credit trading retail investors. In order to compare with the clustering value of margin trading, the clustering value of general retail investors is divided into buyer clustering value (BHM_{it}^{INDI}) and seller clustering value (SHM_{it}^{INDI}) according to the method of Wermers (1999) , and compared ²with the clustering value of credit traders to test hypothesis 1 .

2.3.2 The stock characteristics of the credit trading clustering effect

Stock characteristics including company size, liquidity, lottery preference, and information trading probability. According to Wermers (1999) , Shyu and Sun (2010) , and Hsieh (2013) , factors that affect investor clustering include variables such as size, liquidity, past returns, and market returns. Therefore, this project will take these variables into account in the regression model. To identify the lottery preference of stocks , this project uses Kumar (2009) screening method. Since the research period is as long as 20 years, the stock characteristics may change over time, so the screening is repeated at the beginning of each year. The screening conditions are (1) low stock price: sorting by the closing price at the end of the previous year, screening out stocks below the median; (2) high heterogeneity skewness: according to Harvey and Siddique (2000) model, using the daily returns of the past six months to run regressions , the dependent variable is the daily excess return of the individual stock, the independent variable is the market risk premium and its quadratic term, the estimated residual term is the third-order moment skewness coefficient, the skewness coefficients of the stocks are sorted, and the stocks above the median are screened out; (3) High heterogeneous volatility: Also using the daily returns of the past six months, the Carhart (1997) four-factor estimation is performed, the estimated residual term is taken as the standard deviation, the heterogeneous volatility of the stocks is sorted, and the stocks above the median are screened out. After three rounds of screening, the stocks obtained are lottery stocks , which $Lottery_{i,t}$ represent that company i is classified as a lottery stock in period t . In

² Wermers (1999) calculated the clustering index only based on the buying ratio. Therefore, when the buying ratio is greater than the average market buying ratio, it is identified as a buyer's cluster, and when the buying ratio is less than the market buying ratio, it is identified as a seller's cluster. This method ensures that the same stock will have only one clustering value on the same trading day , which may be a buyer's or seller's cluster.

addition, the information trading probability is measured by the Bayesian Model of PIN_{it} Easley, Hvidkjaer and O'Hara (2002), which represents the information trading probability of company i in period t . The detailed Panel Regression model is as follows:

$$HM_{i,t}^{MB} = a_{i,0} + a_1 Size_{i,t} + a_2 TO_{i,t} + a_3 CAR[t-5, t-1]_{i,t} + a_4 Volatility_{i,t} + a_5 Lottary_{i,t} + \epsilon_{i,t} \quad (4)$$

$$HM_{i,t}^{SS} = b_{i,0} + b_1 Size_{i,t} + b_2 TO_{i,t} + b_3 CAR[t-5, t-1]_{i,t} + b_4 Volatility_{i,t} + b_5 PIN_{i,t} + \kappa_{i,t} \quad (5)$$

Where is $Size$ the company size; TO is the turnover rate, $CAR[t-5, t-1]$ is the cumulative abnormal return of the previous five days, $Volatility$ is volatility, with the current high and low spread as the proxy variable; $Lottary$ is the lottery preference; is the probability of information trading. In addition to testing the stock characteristics of margin trading and short selling clusters, the contingency coefficients of formula (4) are changed to the cluster value of non-credit retail investors (HM_{it}^{INDI}) and the buyer cluster value (BHM_{it}^{INDI}), and the contingency coefficients of formula (5) are changed to the cluster value of non-credit retail investors (HM_{it}^{INDI}) and the seller cluster value (SHM_{it}^{INDI}), so as to observe the differences between credit trading and non-credit trading, and to test hypothesis 2.

2.3.3 The impact of credit trading clustering on stock price returns

This study then discusses the impact of the credit trading clustering effect on subsequent stock price returns. First, according to the method of Wermers (1999), the margin purchase and short selling are sorted from high to low by the clustering index, and the portfolios of margin purchases and short selling are divided into G1~G5. G1 (G5) is the stock portfolio with the lowest (highest) clustering value. Then, the excess returns of each portfolio before and after day t are calculated. The holding period is from 5 days before formation day t to 60 days after formation day t , including $[t-5, t-1]$, formation day t , $t+1$, $t+3$, $t+5$, $t+10$, $t+15$, $t+20$, $t+60$. In addition to the clustering of credit trading, portfolios are also formed according to the buyer clustering value and seller clustering value of non-credit trading retail investors, and the excess returns of different holding periods are calculated. This project infers that the change in stock price returns after high credit trading should be more significant than that of non-credit trading, thereby testing Hypothesis 3 and Hypothesis 3a. To control for other factors

that affect portfolio returns, we conduct a Fama -MacBeth regression test using the four factors of the Carhart (1997) 4-factor model to examine whether portfolios with high margin buying clusters and high margin selling clusters have excess returns during different holding periods. Finally, by observing the stock price returns after the credit trading clustering effect, we attempt to infer the factors that drive the clustering.

3. Empirical analysis

This study will explore credit trading and non-credit trading, and explore the relationship between credit trading and retail investors' herd behavior. It will further divide retail investors' investment behavior into: spot buying, spot selling, margin buying, and short selling. The cumulative abnormal return rate will be used to examine the impact of the credit trading clustering effect on stock price returns based on the number of days the investment target is held.

Table1 below is the descriptive statistical analysis results of the full sample control variables . According to the

sample statistical results , it is divided into characteristics such as company size for observation. Therefore, from the above descriptive statistics, it can be observed that the average value of CCHM in non-credit transactions is smaller than the average values of LHM and SLHM in credit transactions, which is more in line with the expectations of this study. The herd behavior of credit transactions will be greater than that of non-credit

Table1 Summary statistics.

	Mean	Median	Min	Max	Std.	P5	P95	N
HM	0.0588	0.0447	-0.1159	0.7141	0.0658	-0.0202	0.1867	508,978
HM	0.0595	0.0432	-0.1359	0.5379	0.0703	-0.0219	0.1967	243,263
SHM	0.0589	0.0459	-0.1454	0.5962	0.0654	-0.0206	0.1829	276,159
Margin_HM	0.0813	0.0604	-0.1596	0.7953	0.1101	-0.0585	0.2939	446,118
Short_HM	0.2404	0.1487	-0.1324	1.0000	0.2451	-0.0372	0.7143	383,654
Size	39,846	6,197	55	17,191,842	324,351	928	139,401	508,978
TO	0.5372	0.1649	0.0001	66.5760	1.3883	0.0155	2.1600	508,978
CAR	-4.8280	-5.0848	-418.8204	107.3197	4.2906	-10.5271	1.6470	508,978
Volatility	2.1296	1.6827	0.1003	18.8202	1.5760	0.5388	5.2966	508,978
Lottary	0.1230	0.0000	0.0000	1.0000	0.3284	0.0000	1.0000	508,978
Pin	0.2027	0.1237	0.0014	1.0000	0.2148	0.0192	0.7086	508,978

*Note:*HMrepresents non-credit trading herd behavior; SHM represents non-credit trading seller herd behavior; Margin_HM represents financing herd behavior; Short_HM represents short selling herd behavior; Size represents company size; TO represents turnover ratio; CAR represents cumulative abnormal return; Vol represents volatility.

transactions. In addition, the value of the variable Size is much larger than that of other variables . In order to ensure the stability of the study, in the subsequent regression analysis, this study will take the natural logarithm of this variable for subsequent research.

Table2 Retails' herding in spot market and credit market

PanelA Retails' herding in spot market									
	HM			Buy_HM			Sell_HM		
	Model1	Model2	Model3	Model1	Model2	Model3	Model1	Model2	Model3
Inter.	-0.0232***	-0.0236***	- 0.0266** *	- 0.0375** *	- 0.0383** *	- 0.0393** *	- 0.0217** *	- 0.0218** *	- 0.0252** *
	(-4.9379)	(-5.0655)	(-5.7653)	(-7.2825)	(-7.4971)	(-7.658)	(-2.9752)	(-2.9922)	(-3.5909)
<i>Lottery</i>		0.0005			0.001*			0.0002	
		(1.1895)			(1.7364)			(0.3297)	
<i>IA</i>			0.0059** *			0.0034**			0.0065** *
			(5.9962)			(2.5646)			(3.7721)
<i>TO</i>	0.001***	0.001***	0.0009** *	0.0036** *	0.0036** *	0.0035** *	- 0.0007** *	- 0.0007** *	- 0.0008** *
	(10.0683)	(10.0293)	(9.6309)	(17.1102)	(17.0824)	(17.1054)	(-5.6749)	(-5.6868)	(-6.2739)
<i>CAR[-5,-1]</i>	0.0002***	0.0002***	0.0002** *	- 0.0004** *	- 0.0004** *	- 0.0004** *	0.0008** *	0.0008** *	0.0008** *
	(4.471)	(4.4723)	(4.5003)	(-5.4919)	(-5.4773)	(-5.4931)	(10.8411)	(10.8373)	(10.8669)
<i>Volatility</i>	-0.0004***	-0.0004***	- 0.0004** *	- 0.0015** *	- 0.0015** *	- 0.0014** *	0.0007** *	0.0007** *	0.0008** *
	(-3.2717)	(-3.2915)	(-2.8474)	(-7.6182)	(-7.6606)	(-7.5482)	(3.5403)	(3.5353)	(3.8435)
<i>Ln(Size)</i>	0.0094***	0.0094***	0.0096** *	0.0102** *	0.0103** *	0.0103** *	0.0092** *	0.0092** *	0.0094** *
	(19.0871)	(19.3004)	(19.8288)	(18.5431)	(18.8296)	(18.7882)	(12.6035)	(12.6466)	(13.319)
N	519,773	519,773	519,773	243,263	243,263	243,263	276,159	276,159	276,159
Adj. R ²	0.0643	0.0644	0.0653	0.0861	0.0862	0.0862	0.0452	0.0452	0.0472

PanelB Retails' herding in credit market						
	Margin_HM			Short_HM		
	Model1	Model2	Model3	Model1	Model2	Model3
Inter.	0.1291*** (26.2635)	0.1197*** (77.0954)	0.1298*** (26.957)	0.8591*** (53.9883)	0.8531*** (54.9659)	0.8539*** (53.8988)
<i>Lottery</i>		0.001* (1.8914)			-0.0197*** (-13.4291)	
<i>IA</i>			-0.0014 (-1.0891)			0.0138*** (3.2205)
<i>TO</i>	0.0002* (1.6794)	-0.0014*** (-11.2301)	0.0002* (1.701)	0.0003 (0.9595)	0.0002 (0.8635)	0.0002 (0.6106)
<i>CAR[-5,-1]</i>	0.0001* (1.9404)	0.0003*** (5.7755)	0.0001* (1.9491)	-0.0002 (-1.4532)	-0.0002 (-1.5416)	-0.0001 (-1.3618)
<i>Volatility</i>	-0.0023*** (-15.688)	-0.0034*** (-18.7103)	-0.0023*** (-15.847)	-0.0237*** (-56.6114)	-0.0237*** (-56.6969)	-0.0235*** (-57.7285)
<i>Ln(Size)</i>	-0.0042*** (-8.2823)	-0.0032*** (-21.7437)	-0.0043*** (-8.5623)	-0.0623*** (-37.5069)	-0.0613*** (-37.7168)	-0.0621*** (-37.5084)
N	446,118	446,118	446,118	383,654	383,654	383,654
Adj. R ²	0.0017	0.004	0.0015	0.0642	0.0742	0.064

Note: This table presents the results of panel regressions examining the determinants of retail investor herding behavior in the Taiwan stock market from 2018 to 2023. The dependent variables are the daily herding measures (HM) for different trade types. Panel A examines herding in the spot market: overall herding (HM), buy-side herding (Buy_HM), and sell-side herding (Sell_HM). Panel B examines herding in the credit market: margin-buying herding (Margin_HM) and short-selling herding (Short_HM). All independent variables are defined as follows: Lottery is a dummy variable equal to one if a stock exhibits lottery-like features (high idiosyncratic volatility, high idiosyncratic skewness, and low price), and zero otherwise. IA is a measure of information asymmetry, proxied by the Probability of Informed Trading (PIN). Ln(Size) is the natural logarithm of the firm's market capitalization at the end of the previous month. TO is the turnover ratio, calculated as daily trading volume divided by shares outstanding. CAR[-5,-1] represents the cumulative abnormal return over the five trading days prior to day t. Volatility is the standard deviation of daily returns over the past 30 trading days. All regressions include industry and

year fixed effects. The values reported are the regression coefficients, with t-statistics, based on standard errors clustered by firm, shown in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

3.2 Empirical analysis

To explore the determinants of retail investors' herding behavior, this study uses a Panel Regression model for testing. We examine how retail investors' herding behavior is affected by different stock characteristics in the spot market and the credit trading market. Table 2 presents the detailed regression analysis results. Panel A focuses on general transactions in the spot market, while Panel B explores the core of this study — margin and short-selling clustering in the credit trading market.

3.2.1 Herding behavior of retail investors in the spot market

Panel A of Table 2 of the spot market, we observed several interesting phenomena. First, in the model of buying clusters (Buy_HM), the coefficient of lottery preference (Lottery) is positive and significant, indicating that retail investors do tend to gather in stocks with lottery characteristics when conducting general buying transactions.

Second, information asymmetry (IA) is positive and significant in both buyer and seller clusters, which means that when information is The more opaque the environment is, the more retail investors tend to imitate others' decisions. This finding is consistent with the information cascade theory (Bikhchandani, Hirshleifer and Welch, 1992; Banerjee, 1992). A noteworthy finding is that the coefficient of company size (Ln(Size)) is positive,

fact that retail investors' attention is mainly focused on companies with higher reputation.

3.2.2 Retail investors' herding behavior in the credit trading market

(1) Margin-Buying Herding: The results of Panel B in Table 2 provide key evidence for the core hypothesis of this study, clearly revealing the huge difference in behavioral motivations between margin buying and short selling. Margin-Buying Herding : A Behaviorally-Driven Speculation The results strongly support the argument that "margin buying herding of retail investors is mainly driven by behavioral biases.

In Model 2, the coefficient of Lottery Preference is 0.001 and is statistically significant. This indicates indicating that retail investors' herding behavior is more obvious in large-cap stocks, which may be related to the

that when retail investors use leverage to buy, their clustering phenomenon is more serious on lottery-type stocks with high skewness and high volatility . This result confirms the view of Ladley et al. (2016) that the distorted compensation structure of margin trading attracts investors who seek excitement and entertainment.

The coefficient of Information Asymmetry (IA) in Model 3 is insignificant. This is in stark contrast to the results of the spot market, suggesting that retail investors' financing clustering is not due to insufficient information, but to other non-information factors. In addition, retail investors prefer small stocks, and the

coefficient of Company Size ($\ln(\text{Size})$) is negative and significant. This means that financing clustering occurs more often in smaller companies, which are usually more volatile and more in line with speculators' preferences.

For front-end return ($\text{CAR}[-5,-1]$), the coefficient is positive and significant, indicating that margin traders

Table 3. **Retail non-credit trading: cash stock purchase and current stock selling**

Retail non-credit trading-cash stock purchase										
	(t-5)	(t)	(t+1)	(t+3)	(t+5)	(t+10)	(t+20)	(t+30)	(t+40)	(t+60)
G1	- 0.4525***	- 0.1787** *	-0.0163	-0.0035	0.0052	0.0357	0.126	0.1770*	0.2084* *	0.2307* *
	(-9.17)	(-8.38)	(-1.36)	(-0.26)	-0.36	-1.11	-1.17	-1.34	-1.42	-1.39
G2	-0.1182**	- 0.2755** *	-0.0312**	- 0.0309*	-0.0293	-0.0227	0.0485	0.1529	0.1371	0.0773
	(-2.05)	(-12.11)	(-1.36)	(-1.80)	(-0.56)	(-0.30)	-0.44	-1.15	-1.02	-0.47
G3	- 0.3931***	- 0.4270** *	-0.0208	-0.0079	-0.006	-0.0313	-0.0124	-0.0063	-0.0781	-0.1074
	(-6.94)	(-14.88)	(-0.91)	(-0.30)	(-0.21)	(-0.57)	(-0.23)	(-0.09)	(-0.88)	(-1.01)
G4	-0.0163	- 0.2222** *	-0.0093	-0.0049	0.0019	0.0135	0.0528	0.0631	0.0707	0.0614
	(-0.30)	(-7.06)	(-0.43)	(-0.20)	-0.07	-0.23	-0.83	-0.78	-0.76	-0.57
G5	0.4468***	0.3204** *	0.0336*	0.0168	0.0162	0.0322	0.051	0.0441	0.0177	-0.0129
	-6.06	-6.99	-1.81	-0.64	-0.64	-0.76	-0.89	-0.61	-0.21	(-0.14)
G5- G1	0.8993***	0.4991** *	0.0499** *	0.0203	0.011	-0.0035	-0.075	-0.1329	- 0.1907*	- 0.2436* *
	-7.37	-3.55	-2.78	-0.86	-0.47	(-0.08)	(-0.63)	(-0.97)	(-1.29)	(-1.58)

Retail non-credit trading - current stock selling

	(t-5)	(t)	(t+1)	(t+3)	(t+5)	(t+10)	(t+20)	(t+30)	(t+40)	(t+60)
G1	$\bar{0.4525^{**}}$ *	$\bar{0.1787^{**}}$ *	-0.0163	-0.0035	0.0052	0.0357	0.126	$\bar{0.1770}$ *	$\bar{0.2084^*}$ *	$\bar{0.2307^*}$ *
	(-9.17)	(-8.38)	(-1.36)	(-0.26)	-0.36	-1.11	-1.17	-1.34	-1.42	-1.39
G2	-0.1182**	$\bar{0.2755^{**}}$ *	$\bar{0.0312^{**}}$	-0.0309*	$\bar{0.0293}$	$\bar{0.0227}$	0.0485	0.1529	0.1371	0.0773
	(-2.05)	(-12.11)	(-1.36)	(-1.80)	(-0.56)	(-0.30)	-0.44	-1.15	-1.02	-0.47
G3	$\bar{0.3931^{**}}$ *	$\bar{0.4270^{**}}$ *	-0.0208	-0.0079	-0.006	$\bar{0.0313}$	$\bar{0.0124}$	$\bar{0.0063}$	-0.0781	-0.1074
	(-6.94)	(-14.88)	(-0.91)	(-0.30)	(-0.21)	(-0.57)	(-0.23)	(-0.09)	(-0.88)	(-1.01)
G4	-0.0163	$\bar{0.2222^{**}}$ *	-0.0093	-0.0049	0.0019	0.0135	0.0528	0.0631	0.0707	0.0614
	(-0.30)	(-7.06)	(-0.43)	(-0.20)	-0.07	-0.23	-0.83	-0.78	-0.76	-0.57
G5	$\bar{0.4468^{**}}$ *	$\bar{0.3204^{**}}$ *	$\bar{0.0336^*}$	0.0168	0.0162	0.0322	0.051	0.0441	0.0177	-0.0129
	-6.06	-6.99	-1.81	-0.64	-0.64	-0.76	-0.89	-0.61	-0.21	(-0.14)
G5-G1	$\bar{0.8993^{**}}$ *	$\bar{0.4991^{**}}$ *	$\bar{0.0499^{**}}$ *	0.0203	0.011	$\bar{0.0035}$	-0.075	$\bar{0.1329}$	-0.1907*	$\bar{0.2436^*}$ *
	-7.37	-3.55	-2.78	-0.86	-0.47	(-0.08)	(-0.63)	(-0.97)	(-1.29)	(-1.58)

Note: This table reports the average cumulative abnormal returns (CARs) for quintile portfolios sorted on the daily herding measures of retail credit trading from 2018 to 2023. Each day, all sample stocks are sorted into five quintile portfolios (G1 to G5) based on their herding intensity. G1 represents the portfolio with the lowest herding intensity, and G5 represents the portfolio with the highest herding intensity. Panel A sorts portfolios based on the margin-buying herding measure (Margin_HM), and Panel B sorts portfolios based on the short-selling herding measure (Short_HM). The stocks within each portfolio are equally weighted.

The table entries are the time-series averages of the equally-weighted cumulative abnormal returns for each portfolio over various event windows, expressed in percent. $CAR[t+1, t+k]$ represents the cumulative abnormal return from day $t+1$ to day $t+k$. The "G5-G1" row shows the returns of a zero-cost spread portfolio that takes a long position in the highest herding quintile (G5) and a short position in the lowest herding quintile (G1).

t-statistics are reported in parentheses. They test the null hypothesis that the average portfolio return is zero. The t-statistics are calculated using Newey-West (1987) standard errors with an appropriate number of lags (e.g., 5 lags) to correct for potential autocorrelation in the daily portfolio returns. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

exhibit a momentum strategy of chasing highs, which is one of the typical behavioral biases of retail investors .

To sum up, the financing clustering behavior of retail investors shows the characteristics of chasing momentum, preferring small lottery stocks , and not being affected by information factors. This clearly depicts a picture of speculation driven by overconfidence and gambling mentality.

(2) Short-Selling Herding: An Information-Based Trading In contrast, the short-selling herding behavior exhibits a completely different and more rational appearance.

In Model 3, the coefficient of information asymmetry (IA) is positive and highly significant. This result strongly supports the hypothesis of this study that retail investors' short selling clustering is an information-driven behavior. In companies with less transparent information, short sellers can take advantage of their information advantages, so the clustering phenomenon is more obvious.

Retail investors also actively avoid lottery-type stocks, and the coefficient of lottery preference is significantly negative. This is very strong evidence that retail investors who sell short are rational, and they will consciously avoid lottery-type stocks with unlimited upside potential (and unlimited loss risk for short sellers) . And focusing on small stocks, similar to margin trading, the coefficient of company size ($\ln(\text{Size})$) is also negative and significant, supporting the view that the information advantage of short sellers is more effective in small stocks with less information coverage.

The short selling cluster is less affected by the previous period return. The coefficient of previous period return ($CAR[-5,-1]$) is not significant, indicating that the clustering decision of short sellers is not simply to follow the stock price trend of the past few days, but is based on deeper information judgment.

3.3 The impact of credit trading herding on stock price returns

In modern trading markets, the power of retail investors is growing. Credit trading (including margin trading and short selling) is a key tool to amplify its market influence. The impact of the clustering effect on stock price stability and market efficiency has become a topic of great concern in academia and practice. However, when retail investors use high-leverage tools such as credit trading, does their collective behavior exacerbate the irrational volatility of the market or act as a catalyst for price discovery? The answer to this question is crucial to understanding the decision-making patterns of retail investors and the microstructure of the market.

As shown in Table 3, the behavior pattern of the buying cluster driven by financing shows typical price pressure and short-term reversal. This cluster can create a significant price increase on the trading day, but this effect is short-lived and then quickly dissipates, and there is no sustained positive return in the long run. This strongly suggests that the driving force behind it is the behavioral bias of investors such as overconfidence and chasing high emotions, rather than fundamental information. Financing leverage plays the role of emotional amplifier here, allowing the irrational expectations of retail investors to cause more severe short-term impact on the market.

Table 4. Retail credit trading: Margin buying and short selling

Retail Credit Trading - Margin Buying										
	(t-5)	(t)	(t+1)	(t+3)	(t+5)	(t+10)	(t+20)	(t+30)	(t+40)	(t+60)
G1	- 0.2746** *	-0.1458***	-0.0117	-0.0021	-0.0062	-0.0085	0.0364	0.0752	0.1169*	0.1499*
	(-5.87)	(-7.25)	(-0.57)	(-0.11)	(-0.13)	(-0.13)	-0.37	-0.63	-0.88	-1.02
G2	0.2466** *	-0.0572***	-0.0041	0.0267	0.0481	0.1066*	0.2550*	0.3918* *	0.4871** *	0.6566** *
	-4.56	(-2.50)	(-0.18)	-1.17	-0.91	-1.7	-1.43	-2.35	-3	-4.01
G3	0.2054** *	0.0008	0.0067	0.021	0.0374	0.1129*	0.2543* *	0.3652* **	0.4496** *	0.6213** *
	-4.12	-0.03	-0.31	-0.89	-0.66	-1.76	-2.05	-2.56	-2.87	-3.63
G4	0.3813** *	0.0543**	0.0084	0.0163	0.0373	0.0772	0.2132*	0.2985* *	0.3920** *	0.5739** *
	-6.74	-2.28	-0.35	-0.6	-0.58	-1.09	-1.69	-2.01	-2.41	-3.26
G5	-0.0893	0.1708***	0.0142	0.0064	-0.0284	0.0269	0.1748*	0.2425* *	0.3117** *	0.3672** *
	(-1.33)	-6.42	-0.58	-0.22	(-0.41)	-0.35	-1.75	-2.13	-2.53	-2.73
G5-G1	0.1853**	0.3166***	0.0259	0.0085	-0.0221	0.0354	0.1384	0.1673	0.1948	0.2173*
	-2.08	-4.88	-0.89	-0.21	(-0.33)	-0.38	-1.41	-1.5	-1.57	-1.68

Retail credit trading - short selling

	(t-5)	(t)	(t+1)	(t+3)	(t+5)	(t+10)	(t+20)	(t+30)	(t+40)	(t+60)
G1	0.1318**	-0.1206***	0.003	0.0273	0.043	0.0757	0.1735*	0.2681**	0.3590**	0.5927** *
	-2.32	(-5.25)	-0.13	-0.66	-0.79	-0.97	-1.55	-1.99	-2.36	-3.45
G2	0.5227***	0.0883***	0.004	0.0215	0.0463	0.1311 *	0.2688**	0.4012***	0.4866** *	0.6565** *
	-8.64	-3.22	-0.16	-0.88	-0.79	-1.58	-2.24	-2.72	-2.37	-3.39
G3	0.3300***	0.2262***	-0.0149	-0.0523	-0.0628	-0.0462	0.0405	0.0916	0.1719	0.2344*
	-5.14	-7.21	(-0.56)	(-1.64)	(-0.96)	(-0.46)	-0.43	-0.79	-1.26	-1.65
G4	-0.0706	0.1187***	-0.0094	-0.0381	-0.0792	-0.117	-0.1264	-0.1802	-0.2764*	- 0.3831**
	(-1.08)	-3.98	(-0.34)	(-1.29)	(-1.13)	(-1.22)	(-1.29)	(-1.53)	(-2.11)	(-2.59)
G5	-0.3157***	-0.0516*	-0.003	-0.0038	-0.0376	-0.1138	- 0.3549** *	-0.2523**	- 0.3659** *	- 0.4916** *
	(-4.81)	(-1.78)	(-0.10)	(-0.11)	(-0.46)	(-1.04)	(-3.02)	(-1.97)	(-2.57)	(-3.20)
G5-G1	-0.4475***	0.0690**	-0.006	-0.0311	-0.0806	- 0.1895 *	- 0.5284** *	- 0.5204***	- 0.7249** *	- 1.0843** *
	(-5.28)	-2.2	(-0.19)	(-0.56)	(-1.11)	(-1.83)	(-3.75)	(-3.28)	(-4.16)	(-5.48)

Note: This table presents the time-series average coefficients from Fama-MacBeth (1973) regressions of future stock returns on herding measures and other control variables. The sample covers non-financial firms listed on the Taiwan Stock Exchange from 2018 to 2023. In the first stage, cross-sectional regressions are run for each day. In the second stage, the time-series averages of the daily coefficients are reported.

The dependent variables are the cumulative abnormal returns (CARs), expressed in percent, over various future horizons as indicated in each column header (e.g., CAR[t, t+1], CAR[t, t+5], etc.). The main independent variable of interest, HM, is the margin-buying herding measure (Margin_HM) in Panel A and the short-selling herding measure (Short_HM) in Panel B. The control variables are defined as follows: Beta is the market beta estimated from the CAPM using daily returns over the prior year. Ln(Size) is the natural logarithm of the firm's market capitalization. Ln(B/M) is the

natural logarithm of the book-to-market ratio. $CAR[-6,-1]$ is the cumulative abnormal return over the past six months, excluding the most recent month, serving as a proxy for price momentum. $CAR[-36,-7]$ is the cumulative abnormal return from month -36 to month -7, proxying for long-term reversal. TO is the average daily turnover ratio over the past month.

The reported coefficients are the time-series averages from the second-stage regressions. The t-statistics, shown in parentheses, are calculated from the time-series of the cross-sectional coefficients with a Newey-West (1987) correction for autocorrelation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

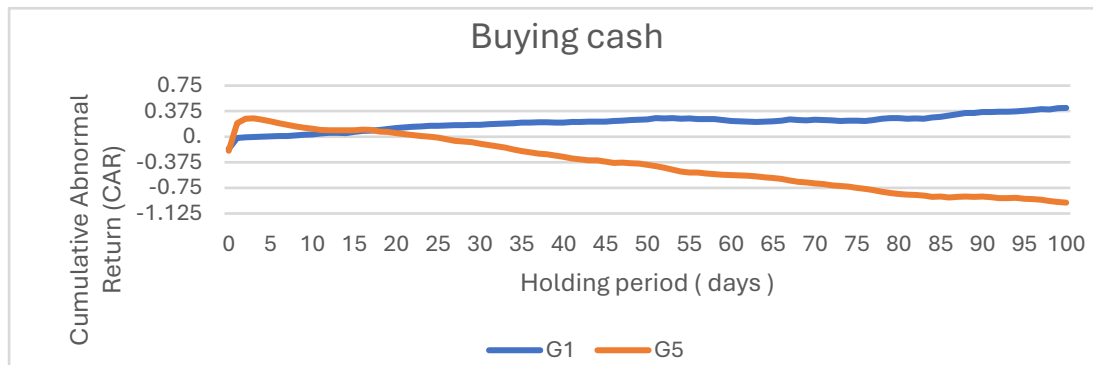
In sharp contrast, the selling cluster driven by short selling shows amazing long-term negative predictive power. Although there may be interference from market noise near the event date, from the long term ($t+10$) to ($t+60$), stocks with high short selling clusters show persistent and deepening negative cumulative abnormal returns. This means that the retail short selling group is not blindly following, and its collective actions contain real negative information about the company's prospects, thus playing a key role as a price discoverer in the market. In this scenario, the high cost and high risk characteristics of short selling become an effective filter, ensuring that participants are mature individuals with high conviction and information advantages.

3.3.1 The impact of retail investors' herding behavior in the spot market on stock price returns

Table 4 provides direct evidence on how herding behavior in credit trading affects stock price returns. We not only confirm the existence of herding effect, but more importantly, the study reveals that retail investors' behavioral motivations, market roles, and contributions to the price discovery process are fundamentally different under different trading instruments.

For retail investors' buying or selling of spot stocks in the spot market, empirical evidence can be used to determine the impact of the herding effect on stock price returns, which can be determined by whether the difference in returns ($G5-G1$) between the "high- herding investment group ($G5$)" and the "low- herding investment group ($G1$)" is statistically significantly different from zero. If there is a significant difference between the two, it means that herding behavior has a substantial impact on stock prices.

The short-term impact of the herd effect on spot buyers is significant. During the period (t+1) to (t+5) after the herd event, the returns of the G5-G1 portfolio were significantly positive. This means that the behavior of retail investors buying in a concentrated manner can indeed significantly push up stock prices in the short term, making them outperform those stocks that are not bought in a herd. However, the long-term reversal is significant. At (t+40) and (t+60), the returns of G5-G1 turned significantly negative. This proves that the initial price increase is not based on fundamentals, but a temporary phenomenon driven by herd behavior. In the long run, the price will correct back.



However, the event day impact on spot sellers is extremely significant, that is, on the trading day (t), the return rate of the G5-G1 investment group showed a positive difference of 0.7440%, and the t-test coefficient reached an astonishing 23.64. This means that there is a huge divergence in the price trend of stocks with high selling clusters and stocks with low selling clusters on that day, proving that the collective selling pressure has a drastic immediate impact on the market. Its impact is also significant on long-term results. At (t+60), the return rate of G5-G1 is still significantly positive. This once again confirms that retail investors

The long-term trends of stocks that are sold in groups have significantly different empirical results from those of other stocks.

In summary, there is a statistically significant difference in stock returns between the high-cluster group (G5) and the low-cluster group (G1), whether buying or selling, which clearly confirms the existence of a strong herding effect among spot investors. Their collective actions are sufficient to have a measurable and empirically non-negligible impact on stock prices in both the short and long term.

3.3.2 The impact of retail investors' herding behavior in the credit market on stock price returns

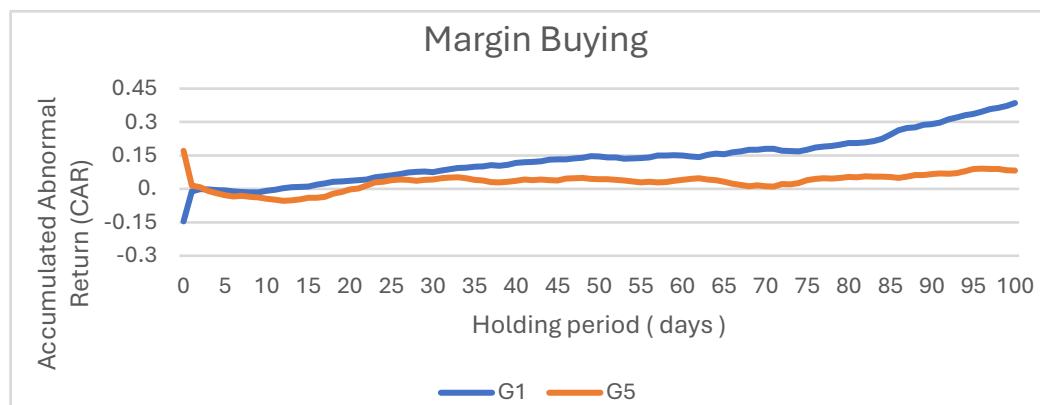
In Taiwan's credit trading market, margin trading is mainly used as an important leverage tool. Compared with legal persons, retail investors are subject to relatively loose regulatory restrictions. However, credit trading is a double-edged sword . Does it make retail investors' trading behavior more informative or simply amplify the irrational emotions of the market? This section analyzes this phenomenon through Table 4, exploring the heterogeneous effects of the clustering effect caused by the two main aspects of credit trading on the cumulative returns of stock prices; and reveals a contrasting and rich picture, confirming that the clustering behavior of

retail investors in the credit market is not a single model, but presents the characteristics of "one body and two sides" , which echoes the results in the literature. The empirical results show how clustering behavior in credit trading affects stock price returns. We not only confirm the existence of clustering effects, but more importantly, the study reveals that there are fundamental differences in the behavioral motivations, market roles and contributions of retail investors to the price discovery process under different trading tools. Its main economic implications can be summarized as follows:

(1) The dual role of leverage: an amplifier of emotions and a filter of information: When financing acts as an emotion amplifier, its clustering effect presents an extremely short-term price shock. The high-cluster portfolio (G5) only generated a significant positive return of up to 0.32% on the event day (t), but this effect completely disappeared one day later (t+1), and the subsequent returns were insignificant. The economic implication of this " flash " phenomenon is that financing leverage greatly enhances the instantaneous purchasing power of retail investors' emotional trading (such as chasing highs and overconfidence), causing severe short-term pressure on stock prices. However, since this behavior lacks fundamental information support, the market can identify its noise nature in a very short time and quickly correct it, making it impossible to form a sustained price trend. This is consistent with the noise trader risk theory of De Long et al. (1990), that is, noise trading can cause temporary price deviations, but will eventually be corrected by market forces.

As an "information filter", short selling is in sharp contrast to margin buying. The clustering behavior of short selling shows significant long-term negative predictive

ability. The negative return of the high-cluster investment group began to appear at $(t+10)$ and continued to expand over time, reaching -1.08% at $(t+60)$. This confirms the theory of Diamond and Verrecchia (1987), that high transaction costs make short selling a reliable negative signal. Only those investors who have real negative information and have a high degree of confidence are willing to take the high risk of short selling. Therefore, the function of leverage here is to screen out more mature and rational "informed traders" in the market. Their collective actions accelerate the process of integrating negative information into stock prices, thereby improving the pricing efficiency of the market.



(2) Asymmetry of the price discovery process and market friction: The "one-day market" of margin buying shows the short-term nature of emotional shocks. Although the market is difficult to resist the buying shock driven by emotions in the short term, its correction efficiency is extremely high. In addition, the delayed absorption of negative information by the short selling cluster even showed a short-term significant positive return on the same day (t), which may reflect the existence of structural frictions such as "short squeeze" against short sellers in the market. Its real negative impact did not emerge stably until after $(t+10)$, which suggests that the market's digestion process of negative information is much slower and more resistant than digesting positive emotions or noise. This phenomenon supports the view that there is an optimistic bias in the market and that the channels for the dissemination of negative information are relatively unsmooth. In addition, the significant negative return before the event $(t-5)$ also suggests that there may have been information leakage or information traders' advance layout before the herd behavior occurred.

4. Conclusion

In the Taiwanese investment market where retail investors are increasingly influential, credit trading is not only a tool for them to expand investment leverage, but the herding behavior it triggers also has a profound impact on the market's price discovery efficiency and stability. This study aims to fill the gap in the past literature that failed to systematically link credit trading with herding effects. By examining the financing and securities lending behaviors of retail investors in the Taiwanese securities market, this study deeply analyzes the causes and patterns of herding phenomena and their heterogeneous effects on future stock price returns. The main contribution of this study is that it empirically distinguishes for the first time the different investor profiles displayed by retail groups under different credit trading tools, providing a new perspective for understanding the complexity of retail investors.

This study first confirmed that whether it is margin buying or short selling, the degree of clustering is significantly higher than that of spot trading retail investors who do not use leverage. This finding means that credit trading itself, due to its high risk and high return characteristics, attracts investors who are more inclined to collective action, or are more easily influenced by the decisions of others during the trading process .

The more critical finding is that the driving factors of margin trading and short selling herding behavior show fundamental differences, revealing the heterogeneity within the retail investor group. In terms of margin buying, our research results support that its herding behavior is mainly driven by behavioral biases and speculative motives. Empirical results show that the phenomenon of margin trading is particularly significant in stocks with smaller companies, poorer liquidity, and "lottery characteristics" such as high volatility and high skewness . This is consistent with the argument in previous literature that retail investors' margin trading is highly correlated with behavioral biases such as overconfidence and excitement seeking . These investors are not based on in-depth fundamental analysis, but are driven by market sentiment and the pursuit of short-term high returns, and they are collectively flocking to specific targets.

In sharp contrast, the herding behavior of short selling shows stronger information-driven characteristics. The results show that the degree of short selling

clustering is significantly positively correlated with the degree of "information asymmetry" of individual stocks. This means that short selling traders among retail investors are likely to be a relatively more mature group that has mastered certain private information or has stronger analytical capabilities. Since short selling itself faces high costs and potential unlimited loss risks, this mechanism naturally screens out "information traders" who have a high degree of negative confidence in the company's prospects. Their herding behavior is not blindly following the trend, but rational decisions made based on similar negative information or judgments.

Finally, these two types of herding behaviors driven by different motivations have completely different effects on future stock price returns, which further verifies our inference. We observed significant short-term price increases and long-term price reversals in stocks with margin buying clusters. This means that the stock prices pushed up by margin clusters lack fundamental support and are only temporary phenomena caused by short-term buying pressure. In the long run, prices will eventually return to their due value, and investors who follow such clusters will face the risk of losses. On the contrary, we found persistent and significant long-term negative abnormal returns in stocks with short selling clusters. This "price continuity" phenomenon is strong evidence that trading behavior is rich in information content, indicating that short selling clusters successfully predicted the long-term decline in stock prices. Their collective actions accelerated the market's absorption of negative information, thereby playing a positive role in improving market pricing efficiency.

This study paints a picture of retail investors as a group that is not homogeneous . On the financing side, credit trading amplifies the irrational emotions of retail investors and becomes a source of market noise; on the securities lending side, it selects a group of rational market "price discoverers" and becomes a force to promote market efficiency.

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An Application of the Centipede Game on the Telecommunications Industry in Taiwan

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Abstract

This study applies a centipede game on the analysis of marketing strategies in the telecommunications industry in Taiwan by analyzing the competing, cooperating, and interacting strategies between main telecommunication companies. Taiwan's telecommunications industry has reached a saturation point, with little to no profit or survival space for new entrants competing in the market. The strategy of mergers and acquisitions in the telecom sector offers several benefits, including improved operational efficiency, expanded market coverage, optimized resource allocation, and strengthened technological innovation capabilities. After mergers, telecom companies can reduce costs, enhance resource utilization, and boost their competitive edge in the market.

Key words: Centipede game, Telecommunications industry, Merger strategy.

蜈蚣賽局在台灣電信產業發展歷程之應用

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摘要

本研究利用蜈蚣賽局探討台灣電信業者間的擴張策略，分析電信服務提供商間的競爭、合作以及互動策略。台灣的電信產業已經處於飽和狀況，在新設企業加入競爭已沒有獲利甚至生存空間。電信業的合併策略，帶來了多方面的好處，包括提升營運效率、擴大市場覆蓋、優化資源配置和強化技術創新能力。合併後，電信公司能減少成本、提升資源利用效率和增強市場競爭力。

關鍵詞：蜈蚣賽局，台灣電信產業，合併策略。

壹、緒論

台灣電信產業歷經兩次的自由化，電信市場由獨佔轉為寡占，也從公營事業轉為民營事業，對於整個市場結構與各電信業者之間的競爭策略上產生根本性變化。近年來，台灣電信產業的發展歷程經歷了一系列重要事件，其中包括 499 吃到飽之亂（財經新報，2022）、電信業者 4G 與 5G 競爭（奇摩新聞，2023）、以及最近台灣大哥大併台灣之星與遠傳併亞太電信的大吃小合併競爭（IThome，2023），這些事件對產業格局和競爭策略產生了深遠影響。

大吃小合併競爭也是台灣電信產業的顯著特點，一些較小的電信公司被大型電信營運商併購，這種趨勢造成了電信市場大者恆大的格局，提升了少數大型電信公司的市場地位（風傳媒，2023）。這種合併競爭推動了市場集中度的提高，對政策制定者和監管機構提出了新的挑戰，因此需要權衡市場競爭和市場動態之間的關係。

賽局理論在商業競爭上具有廣泛的應用，例如企業在競爭激烈的市場中必須選擇適當的競爭策略，而賽局理論可用於模擬各種競爭情景，以幫助企業制定戰略。此外，公司之間常常面臨價格競爭，賽局理論可用於分析不同定價策略的影響。賽局理論也可以解釋市場佔有率爭奪的策略，或分析合併與收購交易中，雙方的策略和潛在市場影響。本研究以蜈蚣賽局理論分析大吃小的合併競爭，探討電信公司在市場環境變動中的產業合併策略，並解析其策略意涵。

貳、研究方法

蜈蚣賽局（Centipede Game）描述了兩名參與者之間的遞迴遊戲，其中每位參與者在每一輪都必須做出合作或背叛的決定。這種博弈以蜈蚣的身體形狀為基礎，每一節身體代表一輪的遊戲。遊戲的目標是共同合作以獲得最大的總報酬，但同時也面臨著誘惑在任何一輪中背叛對方，獨自獲得當前報酬。

在資訊完全的蜈蚣賽局中，此賽局中兩位參賽者在各期可以選擇“合作”或是“不合作”。如圖 1 蜈蚣賽局模型，每次合作後總收益都會不斷增，直到最後兩人都得到 100 的收益，此時總收益最大，可是這樣的結局很難達成，因為大家都在追求自身利益最大。如圖中最後一期由 P2 選擇，它會選擇“不合作”，理由是 $101 > 100$ ；P1 考慮到 P2 在最後一期將選擇“不合作”，因此它在倒數第二期時將選擇“不合作”，因為 $99 > 98$ 。如此往前推論下去，符合 Nash 均衡概念的最後結論是：在第一期時 P1 將選擇“不合作”，此時各自的收益只有 1。

在資訊完全的蜈蚣賽局中，參賽者只能根據下一局的期望報酬回推現在的最適策略，在此情況下，只要雙方持續合作，報酬將以「進2退1」的方式前進賽局的進程。一個產業如果符合寡占特性，則更容易形成「表面競爭、私下合作」默契的方式進行競合關係。雙方將因為這種競合關係而確保市占率與盈餘，並阻擋其他可能的進入者。如全球性品牌的可口可樂-百事可樂、寶鹼-聯合利華、吉利-舒適台刮鬍刀；台灣的全國-燦坤、屈臣氏-康是美、家樂福-大全聯、7-11-全家..等，不勝枚舉。(張宮熊，2017，頁 193)

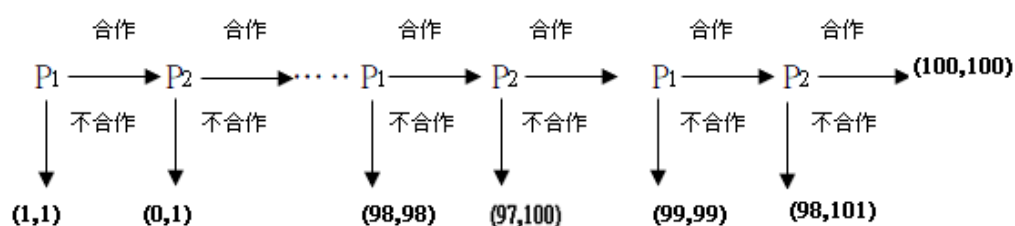


圖 1 蜈蚣賽局基本模式

參、 賽局推演

一、 背景說明

台灣電信市場的合併案背景涉及了數家主要營運商之間的整合，這些案例包括遠傳電信收購亞太電信和台灣大哥大收購台灣之星，此兩起合併將台灣的五家國家營運商縮減為三家，目的是提高市場競爭力，並對抗市場領導者中華電信的優勢地位。合併前的市場分析顯示，這些較大的營運商在關鍵的行動體驗指標上，如下載速度和網路涵蓋率，幾乎在所有方面都優於他們計劃收購的較小營運商。此外，合併被認為有利於推進 5G 技術的發展和應用，也符合政府推行節能減碳的政策。

這些合併案顯示出台灣電信市場正在進行結構性變化，遠亞併與台台併，都指向了業者對提升網路涵蓋率和服務質量的共同目標。儘管合併帶來了對市場競爭潛在影響的擔憂，台灣公平交易委員會卻在認真考量後批准了這起合併案，並規定合併後的公司必須接受現有用戶合約條款，並為特定群體提供優惠資費計劃，這些決策反映出監管機構在促進產業發展和保護消費者權益間尋求平衡的努力。合併後的營運商預期將通過擴大經濟規模來提高營運效率，並希望能夠更好地挑戰市場領導者，從而為消費者帶來更豐富的服務選擇和更優質的網路體驗。

在台灣電信市場的大吃小合併競爭背景下，將台灣電信合併案與蜈蚣賽局相結合分析時，合併方（如遠傳電信和台灣大哥大）和被合併方（如亞太電信和台灣之星），不僅擴大了自身的市場佔有率和網路涵蓋，也顯著提升了在高度競爭的台灣電信市場中的競爭力。這樣的行動引起了市場和監管機構的高度關注，因為這些併購行為可能會改變市場結構，影響競爭格局。

二、 基本假設

賽局的推演建立在基本的假設，包括參賽者是誰？資訊狀況，以及可能的行動策略與其相對應的報酬。(Rasmusen, 1994).

- (1) 參與者：競爭涉及 A 方：台灣大哥大+台灣之星對上，B 方：遠傳+亞太電信。
- (2) 資訊狀況完全：雙方對市場情況、對方策略及可能報酬有全面了解，展現了訊息共享和透明。
- (3) 策略確定性：選定策略後，其結果及報酬不變，指出了策略選擇後的穩定性。
- (4) 資訊對稱：雙方對市場、競價方式等擁有相同的知識，反映了訊息平等。

蜈蚣賽局是一種策略博弈，其中參賽者交替做出決策，每一步決策都可能導致遊戲終止或繼續，並在每一步都有潛在的收益增加。在合併方(台灣大哥大與遠傳電信)與被合併方（亞太電信和台灣之星）的情境中，這種賽局可以類比於兩家公司在合併過程中的策略互動，以及如何在增長市場占有率和避免引起反壟斷關注之間尋找平衡。

台灣大哥大在策略上可能會考慮如何整合台灣之星的資源，包括頻譜、客戶基礎和技術，以最大化合併後的營運效率和市場競爭力。同時，也需要關注如何在不觸發監管機構過度介入的情況下，進行平滑的市場擴張。

遠傳電信在併購亞太電信後，其策略可能會著重於如何有效利用亞太電信在特定市場領域的優勢，以及如何通過這次合併提升自己的創新能力和服務多樣性，從而增強自身在激烈競爭中的立足點。

在蜈蚣賽局中，每一步的決策不僅反映了公司的市場擴張策略，也涉及到如何在合併過程中管理與監管機構的關係，以及如何在公眾和消費者面前正面展示合併的好處。這需要兩家公司在每一步決策中都仔細衡量即時收益與長遠的市場影響。

參賽雙方賽局樹建構如下圖 2 所示：

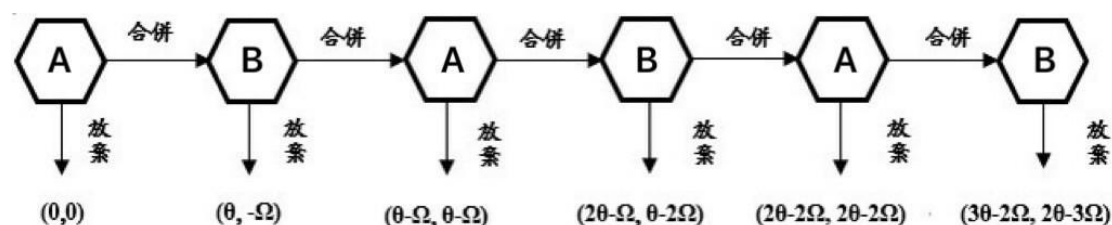


圖 2 蜈蚣賽局數學模式

三、 函數說明

設 θ 是單方採取購併下的增額報酬； Ω 是我方未採取相應購併下的增額損失，兩者之間的比例變數為 a ，代表著當對方採取購併策略時我方市占率或利潤的可能損失比率。

$$\Omega = \theta \cdot a, 0 < a < 1$$

$$(-\Omega, \theta) = (-a\theta, \theta)$$

$$(-\Omega + \theta, \theta - \Omega) = ((1-a)\theta, (1-a)\theta)$$

$$(\theta - 2\Omega, 2\theta - \Omega) = ((1-2a)\theta, (2-a)\theta)$$

a 愈小， $(1-a)\theta$ 愈大

四、 賽局推導

當 A 採取合併，B 採放棄可得 $\theta > 0$

若 B 採合併，A 採放棄可得 $\theta - \Omega > -\Omega$ ，B 得 $\theta - \Omega > 0$

若 A 採合併，B 採放棄可得 $2\theta - \Omega > \theta - \Omega$ ，A 得 $\theta - 2\Omega$

若 B 採合併，A 採放棄可得 $2\theta - 2\Omega$ ，B 得 $2\theta - 2\Omega$

$\theta - \Omega > -\Omega$ ，促使 A 希望 B 採合併

$2\theta - \Omega > \theta - \Omega$ ，促使 B 希望 A 採合併

由上述推導可知：

a 比例愈小其合併的可能性就越大，亦即當對方採取購併策略時我方市占率或利潤的可能損失比率不大，合併對雙方效益皆有提升，因此促使雙方合併的動

機上升。

五、 現況

根據合併前後國家通傳委員會的數據與網路上頻段數據的彙整，台灣大哥大與台灣之星、遠傳與亞太的合併案例，顯示出電信產業大吃小的合併趨勢，此策略通過產生綜效來強化營運能量，提升了市場佔有率和經營規模，進而提高營運效率與競爭力，並有望帶來更廣泛的產業與消費者利益。

電信新三雄版圖				
	總戶數	5G戶數	市占率	2022年營收
中華電	1100萬	239.2萬	36.60%	2167.4億
台灣大哥大	717.9萬	146.8萬	23.90%	1722.1億
台灣之星	268.2萬	67.5萬	8.90%	121.1億
台台併	986.1萬	214.3萬	32.80%	1843.2億
遠傳	713.4萬	173.3萬	23.70%	891.51億
亞太電信	208萬	27.9萬	6.90%	129.3億
遠亞併	921.4萬	201.2萬	30.60%	1020.81億
註：戶數統計至2022年11月				

圖 3 電信新三雄版圖

資料來源:NCC、公開資訊觀測站

肆、 管理意涵

台灣的電信產業已經處於飽和狀況，在新設企業加入競爭已沒有獲利甚至生存空間。電信業的合併策略，如台灣大哥大與台灣之星、遠傳與亞太的合併，帶來了多方面的好處，包括提升營運效率、擴大市場覆蓋、優化資源配置和強化技術創新能力。合併後，電信公司能減少成本、提升資源利用效率和增強市場競爭力，更有效應對市場需求和技術進步，對消費者而言，合併提升了服務質量和網路覆蓋，提供更多高品質電信服務，並加速 5G 網路部署。這些合併要求有效的管理與監管，以確保市場公平競爭和保護消費者權益，促進市場健康發展。合併策略通過提升競爭力和運營效率，帶來顯著的產業和消費者利益，有助於電信產業的持續發展和技術進步。

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A Study on Students' Self-Regulated Learning, Peer Learning, and Professional Competence: Satir's Communication Theory and Self-Integration Theory

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Abstract

Student disengagement in higher education is rising, affecting learning and skill development. This study integrates Satir's communication theory and self-integration theory to enhance self-regulated learning and peer interaction. Satir's model examines emotions and communication, while self-integration theory links identity development to motivation and performance.

Using action research and latent profile analysis (LPA), this study classifies students by response styles and self-integration levels. Data from four university courses were analyzed using ANOVA and Generalized Least Squares (GLS) regression to assess co-creative learning interventions, including industry mentorship, psychological counseling, and project-based competitions. Findings confirm that co-creative teaching improves learning, with project-based competitions having the strongest impact. However, students with high self-integration sometimes showed negative moderating effects, suggesting the need for differentiated strategies. This study refines co-creative teaching and highlights the role of self-integration theory in fostering engagement and professional readiness.

Key words : Satir theory; Self-integration theory; Co-creative teaching, self-regulated learning, peer learning, and professional competency development.

學生自主學習、同儕學習與專業能力之研究—薩提爾與自我統合理論

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摘要

學生學習倦怠日益嚴重，影響學習與技能培養。本研究結合薩提爾理論與自我統合理論，透過行動研究與潛在剖面分析，分析四門課學生的回應型態與自我統合程度。研究顯示，共創式教學能提升學習成效，尤以專題競賽最具影響力，但高自我統合學生在部分情境下反而呈現負向調節，顯示需因材施教，提升參與與職能準備。

關鍵字：薩提爾；自我統合；G20；自主學習；同儕學習；專業能力培養。

壹、 研究背景與目的

本研究關注少子化與疫情影響下，大學生學習動機低落、同儕學習薄弱與專業能力培養困境。教師普遍面臨學生學習態度消極、課堂參與度低、報告文不對題、學習無方向等問題，導致傳統教學模式難以有效提升學生的學習成效與生涯規劃能力。

本研究的 研究目的 在於探討學生自主學習動機低落的成因，並透過 共創式教學環境 設計，結合企業導師指導、專業應用與生涯發展導向，建立可行的教學實踐模式，以提升學生的學習投入與專業成長。目前學界針對 大學生學習動機低落的應對策略 仍缺乏有效的實證研究，特別是在如何透過 同儕學習、師生互動與企業參與 來提升學生學習承諾與專業能力培養方面，仍存在研究缺口 (Research Gap)。因此，本研究結合 薩提爾理論與自我統合理論，提出「生涯未定向—生涯定向—專業定向」三階段模型，並透過教學行動研究法進行實證分析，以驗證共創式教學能否有效提升學生的自主學習與專業技能發展。因此，本教學實踐研究計畫將以薩提爾理論與自我統合理論為基礎，配合行動研究法與潛在剖面分析來進行驗證，希望解決的問題包含：探討大學學生學習動機不佳與自我統合失敗原因為何？

1. 透過 LPA 歸納學生的不同類型（薩提爾回應型態*自我統合類型）
2. 探討不同類型學生，其自主學習、同儕學習和專業技能培養是否有差異？
3. 探討共創式教學環境、自我統合程度所扮演的調節效果角色
4. 最後，希望協助學生發展「生涯發展定向」與「專業定向」

貳、 文獻探討

（一）薩提爾與冰山理論（The personal iceberg metaphor of Satir model）

薩提爾冰山理論是由美國家族治療的先驅的維琴尼亞·薩提爾(Virginia Satir)於 1916-1988 年提出。薩提爾認為每個行動的背後（外在行為），都藏著一座冰山。而我們所看到的冰山儘可能是冰山 1/8 的面貌，還有 7/8 是浮在水面下，其包含難以被觀察的個人的應對方式、感受和情緒、觀點、期待、渴望和自我。例如，學生上課都在滑手機、睡覺、掛網、報告亂做，可能是我們看到的「行為」，而老師感到生氣憤怒也是「行為」。而師生間的衝突間，則必須更進一步去探討師生的應對方式、情緒、觀點...等六個層次。舉例來說，大學教授面對學生上課

滑手機或是掛網，他會表現出「很生氣」、「言語恐嚇或直接將學生手機收起來」、「強迫開鏡頭」。而學生的回應可能是「不高興、趴著睡覺」、「乖乖收起手機、開鏡頭，但是仍無法認真聽課」（如表 1）

表 1：薩提爾模式在師生間隱形冰山的應用（本研究整理）

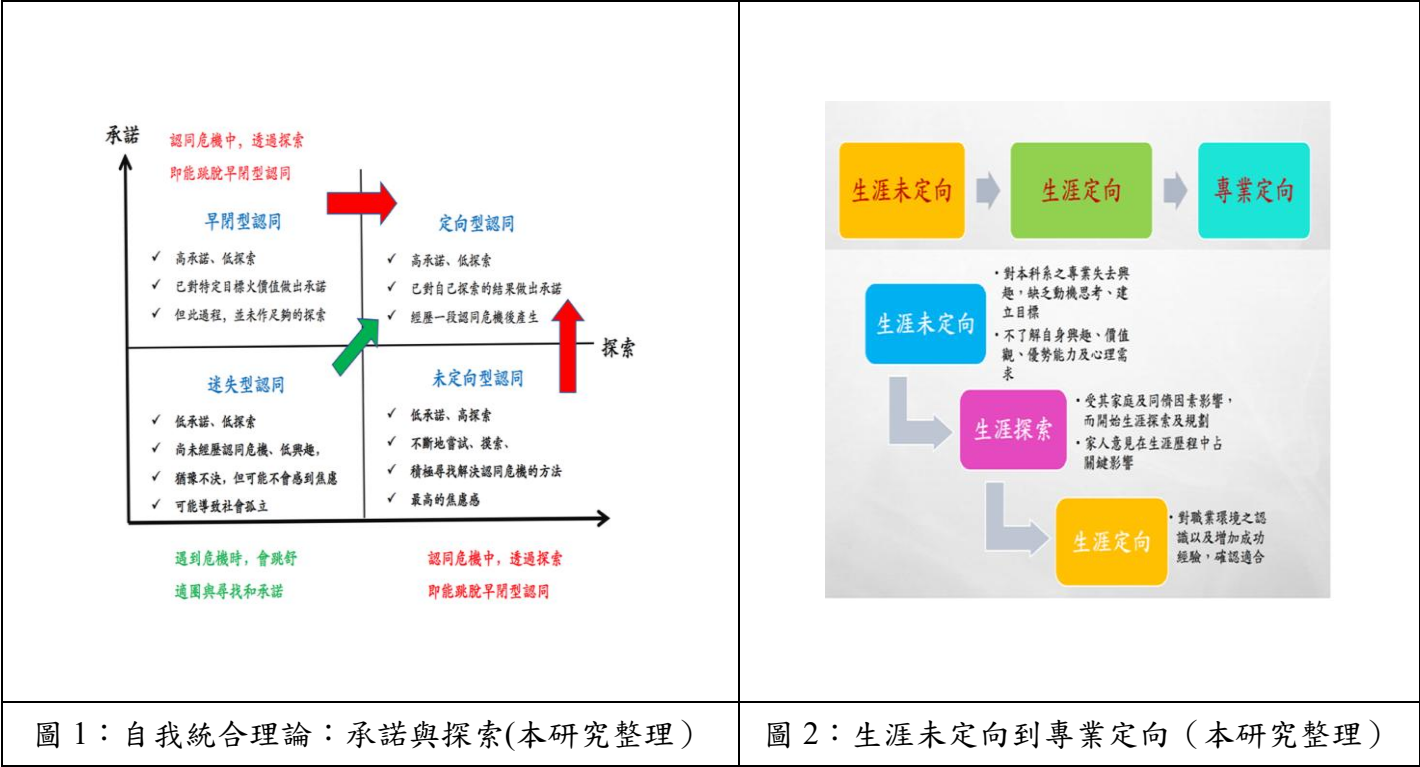
事件	面對學生滑手機，感到很生氣	上課滑手機、無目標
行為	「指責型」、「討好型」	「打岔型」、「討好型」
情緒	恐懼失去地位、不被尊重	恐懼被當、聽不懂、不想聽
觀點	老虎不發威會被當病貓	這必修、老師點名很重要
期待	學生能服從、符合老師的期待	希望被肯定、希望學會
渴望	希望認真準備上課教材，學生能感受到並用心學習	希望聽不懂時，老師能換講法 渴望不要被當、順利畢業
自己	傳道授業解惑也，我其實是為學生好	我其實想聽課，成為更好的自己

（二）自我統合理論 (Self-identity Theory)與生涯定向

自我統合指個體在社會互動中整合各層級的自我認知，以形成穩定且一致的心理狀態³。Marcia 以大學生為樣本，透過訪談宗教信仰、政治理念、性別角色與職涯期望，並以**「探索程度」（是否積極尋求自我認同）與「承諾程度」（是否對未來生涯做出承諾）為依據，發展出四種類型的統合狀態：早閉型統合 (**Identity Foreclosure**) - 高承諾，低探索：早閉型個體未經歷過統合危機，但已對人生規劃（學校、職業）作出承諾，通常受到父母或環境影響。例如，父母希望其進入醫學院，學生未經探索便接受此決定。這種統合非自主選擇，而是依循外部期待。迷失型統合 (**Identity Diffusion**) - 低承諾，低探索：迷失型個體未積極思考未來，對職涯發展無明確方向，僅關注當下生活，對自我認同問題興趣不大。例如，學生未思考職涯發展，僅隨遇而安，不主動尋求未來規劃。未定型統合 (**Identity Moratorium**) - 低承諾，高探索：未定型個體正處於探索階段，努力尋找適合自身的職涯方向，但尚未做出承諾。他們可能對現狀不滿意，容易改變目標，且資源投入不穩定。例如，學生可能對不同職業感興趣，但尚未確定最終

³ Marcia, J. E. (1980). Identity in adolescence. *Handbook of adolescent psychology*, 9(11), 159-187.

選擇，仍在持續探索中。定向型統合 (Identity Achievement)- 高承諾，高探索：定向型個體經歷過探索，對未來生涯已有明確方向並作出承諾。例如，學生確立行醫目標，認同醫生的責任與成就感，因此積極準備考試、累積相關經驗。Marcia (1966) 指出，自我統合是一個動態歷程，受個體的成長與環境影響而變化。在四種統合類型中，僅定向型屬於成功統合，而早閉型、迷失型、未定型則被視為統合失敗，可能影響未來生涯發展與決策穩定性。



（三） 自主學習、同儕學習、專業能力

自主學習 (Self-regulated Learning) 一直是教育界與認知心理學領域的一個重要課題。自主學習從過去教師主導的教學方式，調整為鼓勵學生有意識的、自己主動參與、建構的一種化被動為主動的學習行為⁴。自主學習是一種動態的、週期性的學習，其大致可分為計劃期、執行期與反省期三個階段，學習者自己設定目標並以他們認為有助於實現目標的方式來執行目標，之後再持續監督改善未達目標的地方和外部回饋的意見。過去研究認為，教師期望會對學生的表現有很大的影響。研究發現當教師的期待不同，對兒童施加影響的方法也不同，兒童受

⁴ Schunk, D. H., & Zimmerman, B. J. (2013). Self-regulation and learning.

到的影響與表現也會不同⁵。賴英娟、巫博瀚(2018)以台灣八年級生為樣本，研究發現知覺教師的支持對學生的自我效能、自主學習動機與學習情緒都有正向影響。過去也認為同儕學習在教育現場扮演重要的角色⁶。Gamlat(2022)。此外同儕學習有助於線上知識的交換。同儕學習計畫可以增加以同儕為 mentor 的效果、並且對學員的學習狀況、心態產生正向的影響⁷。因此，本研究認為，在共創式學習過程中，老師、業師、同學、分享平台等，應該透過言語、行動、暗示等來提升學生在課堂上的成就感與自我期許，藉此提升他們的自主學習動機、同儕學習與培養專業技能。根據上述文獻回顧，本研究提出下列假說：

H1a-H1c / H1d-H1f: 不同類型學生(薩提爾類型)/(自我統合類型)，其彼此間的自主學習、同儕學習、專業能力培養有顯著差異。

H2a-H2c: 共創式教學環境(專業、心理、競賽)，對學生的自主學習、同儕學習、專業能力培養有顯著差異影響。

H3a-H3c/ H3d-H3f: 共創式教學環境(有、無)，對不同類型學生(薩提爾類型)/(自我統合類型)的自主學習、同儕學習、專業能力培養有正向顯著影響。

H4a-H4c: 控制其他條件下，學生自我統合程度，對學生的自主學習、同儕學習、專業能力培養有正向顯著影響。

H5a-H5c/ H5d-H5f: 學生自我統合程度，對不同類型學生(薩提爾類型)/(自我統合類型)的自主學習、同儕學習、專業能力培養有顯著影響。

H6a-H6c: 交互作用效果(共創式教學環境有無與自我統合程度)對學生的自主學習、同儕學習、專業能力培養有顯著影響。

參、教學設計與規劃

(一) 研究樣本與設定

本研究主要以四門課為主要的驗證對象。學生的分布包含：統計學(企管系一、二年級)、管理學(會計系一年級，上下學期各一班)、管理科學(企管系二年級，兩班)與作業管理。主要以課程教室為主要研究場域，而學生在進行期中、

⁵ Socas, J. (2021). Pygmalion in the 'hood: Reflecting on Enhancing Job Interview Performance at an Urban Community College. *Journal of the Scholarship of Teaching Learning*, 21(3).

⁶ Gamlat, S. (2022). Peer learning and the undergraduate journey: a framework for student success. *Higher Education Research & Development*, 41(3), 699-713.

⁷ Carvalho, A. R., & Santos, C. (2022). Developing peer mentors' collaborative and metacognitive skills with a technology-enhanced peer learning program. *Computers and Education Open*, 3, 100070.

期末報告時會到業界、實體店面訪談與搜集資料與進行分析，此時的研究場域就會到校外。而學生報告成果也會透過競賽來呈現。

（二）數量分析方法

本研究主要以行動研究法為主要執行架構，並結合薩提爾和自我統合的概念，提出執行規劃、架構並進行實際的教學現場測試。在分析部分，主要透過開學第一週問卷資料搜集、操弄執行後問卷搜集（專業、心理演講）、期末問卷搜集，每位受測者共四次問卷。最後利用潛在剖面分析（LPA）、ANOVA 與 GLS 迴歸進行分析與驗證。但由於自主學習、同儕學習、專業能力培養並非一堂課就能完全改變學生的行為與心態，因此，本研究主要在開學前、執行中（專業、心理演講）、學期末競賽都填答一次問卷，最後檢測的是這三個變數的“改變程度”是否因為課程執行，而有顯著改變。

肆、研究結果分析

（一）學生課堂反應與回饋

本研究主要結合質性觀察與量化問卷分析的方式，來看四門課同學的學習成效與反應。本研究主要利用三個部分來看學生的學習成效，分別包含課堂活動紀錄、學習成效回饋單、期末競賽三個部分，最後再以四次的問卷發放，來分析學生的自主學習、同儕學習和專業技能培養成效。此外，我們也將近年來的成果，建立一個非營利組織的官網，然後公告相關的演講活動與學生表現。演講部分，我們分成自我探索的演講與專業技能演講兩種。自我探索的平均分數介於 3.5~4.4（滿分五分），專業演講平均分數介於 4.1~5（滿分五分）。其中有趣發現，簡略說明如下

課堂讚賞部分：學生對於自我探索活動（牌卡、九宮格、人格量表）多給予正面評價，認為這些活動有助於更深入了解自己。在專業演講方面，張榮華教授運用生活化案例，使實驗設計與統計分析更易理解，學生反應良好。此外，數據分析與廣告投放演講引發學生對數據分析的興趣，而創業相關講座則強化了創意思考與企業經營認識。(2) 意外發現：部分心理師演講評價低於預期，學生認為互動方式未能顧及大班規模，導致參與度不均，甚至有內向學生感到不適。同時，工研院專業演講因專有名詞較多、內容深奧，使部分學生難以跟上，影響評價。這反映出大班授課中，應兼顧學生參與與內容難易度調整。(3) 競賽活動：競賽

激發同儕學習，學生透過觀摩其他組別報告學習創意發想與數據應用，並自我檢討提升報告品質。此外，透過實際案例分析（如路易莎咖啡的顧客行為觀察），學生認識統計與管理科學在生活中的應用，增強學習動機與成就感。整體而言，業師授課、競賽活動與心理師演講有助於學生連結理論與實務，提升學習興趣與自我效能。然而，大班課程的互動設計與專業內容的難度調整仍需進一步優化，以確保學生充分參與並獲得實質學習成效。

（二）自主學習、同儕學習與專業能力之分析

1. 分析結果（敘述性統計）

本研究的主要研究時間涵蓋 112-1 與 112-2 學期，對象為「管理學」、「統計學」、「管理科學」、「作業管理」四門課程的學生進行量化分析。原計畫包含作業管理碩班，但由於學生數僅三人，可能產生分析偏誤，因此不納入統計。最初樣本為 305 位學生，但扣除未填寫完整問卷者後，最終有效觀察樣本為 271 人。研究共進行六個時段的問卷蒐集（2023/10/19-10/20、2023/11/9-11/10、2023/12/21-12/22、2024/1/11-1/12、2024/4/24-4/26、2024/6/19-6/21）。原計畫預期分析共創教學對學生期末成績的影響，但因學生退選、資料無法完全配對，以及數量科目與管理科目評分方式不同，最終未納入成績分析，與原計畫有所不同，特此說明。

本研究聚焦於探討學生回應型態（依據薩提爾理論）與自我統合變化的影響，並透過期初、期中演講活動、期末競賽三階段進行比較。薩提爾分類包含討好型、打岔型、指責型與超理智型，而自我統合則分為迷失型、未定型、早閉型與定向型。從表 2 可見，各階段「討好型」人數皆為最多（佔比 53.51%~61.19%）。期初時，討好型 168 人（61.99%），其次為打岔型 39 人（14.39%）、指責型 33 人（12.18%）、超理智型 31 人（11.44%）。期末則為討好型 145 人（53.51%）、超理智型 54 人（19.93%）、打岔型 41 人（15.13%）、指責型 31 人（11.14%）。雖然卡方檢定結果顯示無顯著差異（ $P>0.05$ ），但觀察趨勢顯示「超理智型」有上升趨勢，值得進一步探討。

人數 (比例)	期初	專業	心理	期末
1:討好型	168 (61.99)	163 (60.15)	154 (56.83)	145 (53.51)
2:打岔型	39 (14.39)	49 (18.08)	50 (18.45)	41 (15.13)
3:指責型	33 (12.18)	35 (12.9)	37 (13.65)	31 (11.44)
4:超理智型	31 (11.44)	24 (8.86)	30 (11.07)	54 (19.93)

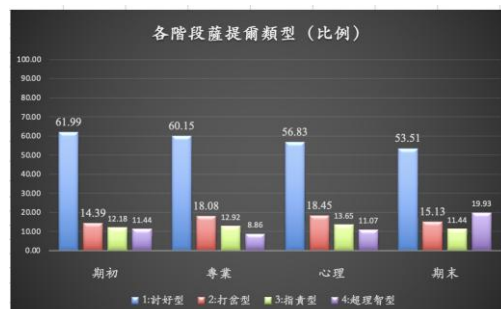


表 2、各階段薩提爾類型人數 (比例)

圖 3：薩提爾類型在各階段比例

由表 3 可以看出，不管在哪個階段，未定型人數最多 (48.34%~56.46%)。不管在哪個階段，確實符合 Super 教授觀察，青少年（大學生）對於人生迷茫的比例偏高，因此未定型在各階段都最高。雖然未達卡方統計顯著 ($p>0.05$)，但是可以看出未定型人數從期初 153 人 (56.46%) 慢慢下降到期末 138 人 (56.46%)。而定向型（最理想型）期初 45 人 (16.61%) 期末仍然是 45 (16.61%)，並沒有因為活動而增加。相反的，在專業或是心理自我探索演講後，定向型反而減少兩個到五個人，迷失型在演講後明顯上漲 (73 人與 69 人)，但在期末迷失型人數有稍微下降，但都高於期初 45 人，表示聽完演講後，學生開始思考除了會計、企管以外的出路，但也有出現學生開始更迷惘的現象。

人數 (比例)	期初	專業	心理	期末
1:迷失型統	45 (16.61)	73 (26.94)	69 (25.46)	55 (16.61)
2:未定型統合	153 (56.46)	131 (48.34)	133 (49.08)	138 (56.46)
3:早閉型統合	28 (10.33)	27 (9.96)	26 (9.59)	33 (10.33)
4:定向型統合	45 (16.61)	40 (14.76)	43 (15.87)	45 (16.61)

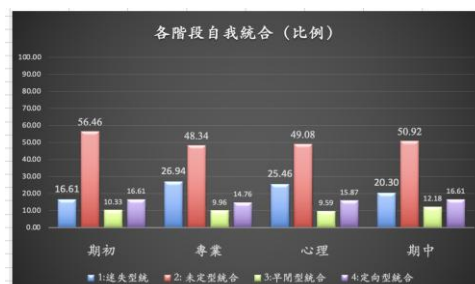


表 3、各階段自我統合類型人數 (比例)

圖 4：自我統合 在各階段比例

2. 分析結果 (Paired t test)

本研究透過潛在剖面分析 (LPA)，結合薩提爾理論與自我統合理論，對學生進行分群 (回應型態 × 自我統合類型)，並利用 R 軟體的 LPA 模組進行分類⁸。薩提爾回應類型包含討好型、打岔型、指責型、超理智型 (編碼為 1-4)，自我統合則分為迷失型、未定型、早閉型、定向型 (編碼為 1-4)。相依變數則透過 MSLQ 問卷測量自主學習、同儕學習、專業能力培養，並輔以自我統合問卷進行評估。為確保信效度，刪除不符合標準的題項，並以構面平均值進行分析。

由於學習動機與能力培養無法在短期內大幅改變，因此本研究於開學前、執行中、學期末進行三次問卷測量，最終檢測三個變數的改變程度是否因課程執行而顯著提升。使用成對樣本 t 檢定，從表 4 結果顯示，專業演講、自我探索演講、期末競賽後，自主學習、同儕學習、專業能力培養皆顯著提升 ($p < 0.001$)。其中，期末競賽影響最大，自主學習改變量 0.39 ($t = 8.69, p < 0.001$)，同儕學習改變量 0.403 ($t = 8.08, p < 0.001$)，專業能力改變量 0.47 ($t = 9.57, p < 0.001$)，均高於專業演講與自我探索演講。

表 4：自主學習、同儕學習、專業能力培養改變度比較

Paired t test	專業演講後		自我探索演講後		期末競賽後	
	MD	t	MD	t	MD	t
自我學習改變度	0.31	7.53***	0.32	7.07***	0.39	8.69***
同儕學習改變度	0.23	5.16***	0.19	4.05***	0.403	8.08***
專業能力改變度	0.39	8.64***	0.41	8.70***	0.47	9.57***

Significant codes: '***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1

3. 理論架構與假說驗證 (總結)

本研究希望可以針對大學生不知道為何念大學「盲」、與對未來感到迷「茫」等現象，以藉此探討薩提爾類型 (回應型態) 與自我統合類型 (統合類型) 來探討學生不同類型間，其在自主學習、同儕學習與專業能力間，是否存在顯著的差異，再進一步討論共創式教學環境和自我統合程度，是否扮演重要的調節效果角色。我們主要利用 ANOVA 與 GLS 迴歸分析 來檢測最後學生提供的分數 (期末

⁸ Fraley, C., & Raftery, A. (2007). Model-based methods of classification: using the mclust software in chemometrics. *Journal of Statistical Software*, 18, 1-13.

問卷)，並驗證下列假說（圖 5 紅色*表示假設成立）。

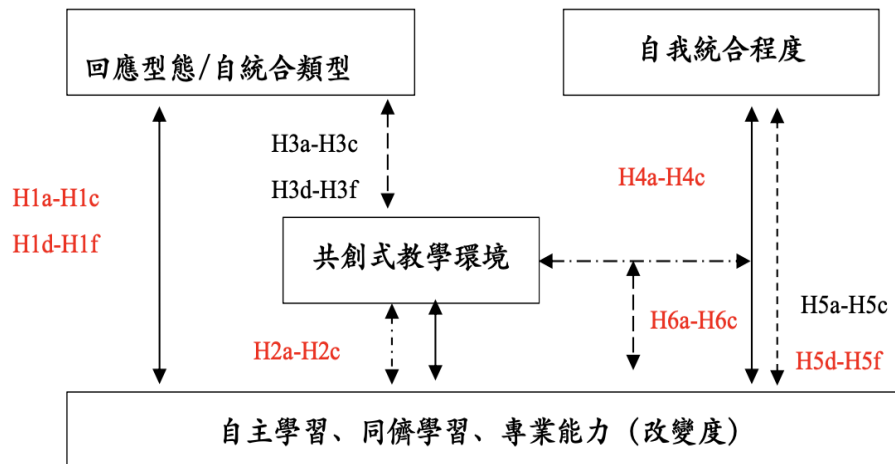


圖 5、量化分析架構圖（紅色為假設顯著）

4.假說驗證詳細分析

本研究提出假設 H1a-H1c:不同類型學生(薩提爾類型)，其彼此間的自主學習、同儕學習、專業能力培養有顯著差異，並用單因子變異數分析(one-way ANOVA)來檢測（表五）。薩提爾不同類型學生的自主學習改變($F(3,1080) = 3.87, p < 0.001$)、同儕學習改變($F(3,1080) = 2.14, p < 0.1$)、專業學習改變有顯著的差異($F(3,1078) = 4.41, p < 0.01$)。由此可以看出 H1a-H1c 都成立，結果顯示不同類型學生(薩提爾類型)，其彼此間的自主學習、同儕學習、專業能力培養有顯著差異。

表 5、單因子變異數分析（薩提爾類型）

自主學習改變	Df.	SS.	MS.	F	P-value
組間變異	3	5.80	1.93	3.87***	P<0.001
組內變異	1080	540.29	0.50		
總變異	1083	546.09			
同儕學習改變	Df.	SS.	MS.	F	P-value
組間變異	3	3.37	1.13	2.14+	<0.1
組內變異	1080	568.02	0.52		
總變異	1083	571.40			
專業學習改變	Df.	SS.	MS.	F	P-value
組間變異	3	7.38	2.46	4.41***	<0.01
組內變異	1078	601.01	0.55		
總變異	1081	608.39			

***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1

如表六所示，事後比較（這邊採用 Bonferroni 檢測），在自主學習改變度部分，1-4(討好型-超理智型)之間有顯著差異 ($t=-0.177, p<0.05$)，表示超理智型在自主學習改變度高於討好型。2-4(打岔型-超理智型)之間有顯著差異 ($t=-0.19, p<0.1$)，表示超理智型自主學習程度改變度高於打岔型。但是其他類型在自主學習改變度上，看不出有明顯差異。接下來，我們比較同儕學習部分，可以看出 2-4(打岔型-超理智型)之間有顯著差異 ($t=-0.19, p<0.1$)，表示超理智型同儕學習改變度高於打岔行型。但是其他類型在同儕學習改變度上，看不出有明顯差異。而在專業學習改變度部分，只有 1-4(討好型-超理智型)之間有顯著差異 ($t=-0.251, p<0.01$)，表示超理智型在專業學習改變度高於討好型，但其他類型無法看出明顯差異。

表 6、事後比較（薩提爾類型）

自主學習改變	N	平均	標準差	Bonferroni	平均差 (p value)
1:討好型	630	3.63	0.67	1-2	0.146
2:打岔型	179	3.62	0.77	1-3	-0.149
3:指責型	136	3.78	0.70	1-4	-0.177*
4:超理智型	139	3.81	0.78	2-3	-0.1642
				2-4	-0.19+
				3-4	-0.02
同儕學習改變	N	平均	標準差	Bonferroni	平均差 (p value)
1:討好型	630	3.77	0.68	1-2	0.075
2:打岔型	179	3.69	0.75	1-3	0.005
3:指責型	136	3.76	0.77	1-4	-0.130
4:超理智型	139	3.90	0.81	2-3	-0.069
				2-4	0.205+
				3-4	-0.136
專業學習改變	N	平均	標準差	Bonferroni	平均差 (p value)
1:討好型	628	3.53	0.71	1-2	-0.075
2:打岔型	179	3.60	0.71	1-3	-0.074
3:指責型	136	3.61	0.78	1-4	-0.251***
4:超理智型	139	3.78	0.87	2-3	-0.004
				2-4	-0.181
				3-4	-0.177

***' 0.001 '**' 0.01 '*' 0.05 '+' 0.1

接下來我們要討論學生知覺自我統合分數的調節效果，本研究接下來會用 GLS 迴歸分析（generalized least squares regression analysis），來進行探討。本研究採用 GLS 迴歸主要原因是因為我們是連續時間的追蹤學生的資料（四門科目、三個階段、共計六次發放問卷），並非傳統的單一時間點研究，因此並沒有採用傳統的 OSL 迴歸分析。且每個模型都以個體-時間點為分析單位，也將時間控制為 dummy variables 放入所有模型中。選擇 GLS 的主要原因在於其能夠校正異質

性及自相關等問題(Lu & Beamish, 2004)2004)。在 GLS 的假設中，若誤差項 ε 的共變異數矩陣結構已知，採用 GLS 進行模型估計將比普通最小二乘法 (OLS) 更為有效。然而，實務上常見的情況是共變異數矩陣 Ω 未知，因此需在執行 GLS 之前先對 Ω 進行估計。如果 Ω 的估計值與真實誤差項的共變異數矩陣相差甚大，採用 GLS 進行估計將導致較大的估計誤差，因此 GLS 的使用需符合數據類型。此外，過往學者指出，在樣本檢測過程中，若隨機效應與固定效應的廣義最小二乘法通過 Hausman 檢定結果無顯著差異，則建議採用隨機效應的 GLS，以獲得更高效且適當的迴歸模型(Jiang et al., 2010)。基於上述考量，本研究最終採用隨機效應的廣義最小二乘法來檢驗所有假設。

本研究假設 H4a-H4c，在控制其他條件下，學生知覺自我統合程度，對學生的自主學習、同儕學習、專業能力培養有正向顯著影響。我們可以從表 7 的模型 1 可以看出，學生認知自我統合程度對自主學習 ($B=0.989, P<0.05$)、同儕學習 ($B=1.034, P<0.05$)、專業能力 ($B=0.929, P<0.05$) 都有顯著的正向影響。H4a-H4c 都成立，顯示學生認知的自我統合程度越高，其在自主學習、同儕學習、專業能力也能越有較高的表現。本研究假設 H5a-H5c: 學生自我統合程度，對不同類型學生(薩提爾類型)的自主學習、同儕學習、專業能力培養有顯著影響。我們可以從模型 2 看出，學生認知自我統合程度對自主學習 ($B=0.007, P>0.05$)、同儕學習 ($B=0.029, P>0.05$)、專業能力 ($B=0.039, P>0.05$) 都沒有顯著的影響。表示 H5a-H5c 都不成立，顯示認知自我統合程度對於薩提爾不同類型對學生的自主學習、同儕學習、專業能力並不存在調節效果。接下來改分析 H5d-H5f 的假設，研究假設學生自我統合程度，對不同類型學生(自我統合類型)的自主學習、同儕學習、專業能力培養有顯著影響。我們可以從表的模型 3 看出，學生認知自我統合程度對自主學習 ($B=0.082, P<0.05$)、同儕學習 ($B=0.094, P<0.05$)、專業能力 ($B=0.139, P<0.05$) 都有顯著的正向影響。H5d-H5f 都成立，顯示學生認知的自我統合程度越高，其對不同自我統合類型在自主學習、同儕學習、專業能力會帶來正向的調節效果。

最後，本研究要驗證 H6a-H6c 的交互作用效果(共創式教學環境有無與自我統合程度)對學生的自主學習、同儕學習、專業能力培養有顯著影響。我們可以從表 7 與省略表格的模型 4 看出，學生認知自我統合程度對共創式教學有無和自主學習 ($B=-0.295, P<0.01$)、同儕學習 ($B=-0.225, P<0.01$)、專業能力 ($B=-0.087,$

P<0.01) 都有顯著影響，但是是負向的。顯示 H5d-H5f 並不成立，且與我們原本假設正向調節效果剛好相反。顯示學生認知的自我統合程度越高，其共創式教學在自主學習、同儕學習、專業能力會帶來負向的調節效果。

表 7、GLS 迴歸分析結果 (自主學習)

相依變數: 自主學習 b	模型 1		模型 2		模型 3		模型 4		模型 5	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
控制變數										
性別	0.031	(0.025)	0.031	(0.025)	0.029	(0.025)	0.028	(0.025)	0.026	(0.025)
年紀	-0.011	(0.008)	-0.011	(0.008)	-0.012	(0.008)	-0.011	(0.008)	-0.012	(0.008)
直接效果										
薩提爾類型	-0.009	(0.011)	-0.034	(0.063)	-0.007	(0.011)	-0.008	(0.011)	0.007	(0.062)
自我統合類型	-	(0.015)	-	(0.015)	-	(0.071)	-	(0.015)	-	(0.071)
	0.157*		0.157**		0.453**		0.169**		0.485**	
	**		*		*		*		*	
共創教學有無	0.000	(0.029)	0.000	(0.029)	-0.005	(0.029)	0.936**	(0.177)	0.965**	(0.176)
							*		*	
認知自我統合程度	0.989*	(0.022)	0.976**	(0.040)	0.813**	(0.047)	1.250**	(0.053)	1.079**	(0.070)
	**		*		*		*		*	
線性調節效果										
薩提爾*認知自我統合程度			0.007	(0.017)					-0.004	(0.017)
自我統合*認知自我統合程度					0.082**	(0.019)			0.008**	(0.019)
					*				*	

共創教學*認知自我統合 程度				- 0.295** *	(0.055) - 0.306** * (0.054)
R2	0.671	0.672	0.677	0.680	0.686
Wald chi2	366.26 ***	313.71* **	321.49* **	326.05* **	260.34* **

Note: a: N=1084 (two-tailed test), +p<0.1; *p<0.05; **p<0.01; ***p<0.001 b: 時間點在所有模型皆有控制 d. 因頁數限制，故省略同儕學習與專業能力培養的表格

伍、 結論與建議

本研究的結果表明，學生在自主學習、同儕學習與專業能力的培養上存在顯著差異，特別是針對不同類型的學生（如薩提爾回應型態、自我統合類型）。研究發現，超理智型和定向型學生在學習改變的程度上表現優於其他類型，顯示他們在課程的影響下更能提升學習成效。此外，共創式教學環境中的專業業師講座、心理師引導以及競賽活動，對於提升學生的自主學習與同儕學習具有顯著效果。然而，對於不同學生類型的交互作用效果不顯著，反映出教學環境的設計對學生成效的影響存在一定的侷限性。此外，學生的自我統合程度與學習成效間的正向關係也得到了驗證，表明自我統合成功的學生更有能力投入學習。值得注意的是，自我統合程度高的學生在共創式教學環境中的表現可能出現負向調節效果，這暗示著學生的自我認知與教學環境間可能存在適應性的矛盾，需要進一步探討其深層原因。

接下來我們提出六個教學上的建議，這些建議旨在縮短師生間的鴻溝，增強學生的學習動機與專業能力，同時有效提升教學的整體效益。

1. 多元化的教學設計：為了更好地滿足不同類型學生的需求，建議在課程中加入更多個性化的學習活動，如分組討論、個別指導和定向任務，以適應不同學生的學習特徵。
2. 加強自主學習能力的培養：針對學生在自主學習上的挑戰，建議提供引導性工具和資源（如學習目標清單、時間管理工作坊），幫助學生建立清晰的學習方向與目標。
3. 深化同儕學習的實施：透過小組競賽、協作式專案以及跨學科合作，進一步強化學生的團隊合作能力與互相激勵效果。同時，監控小組動態，避免內部分歧導致學習效果下降。
4. 運用心理與生涯規劃輔導：引入心理師和生涯規劃專家的指導，幫助學生增強自我認知，提升對未來發展的規劃能力，從而增強其學習動機與方向感。
5. 優化共創式教學環境：雖然共創式教學活動在學習成效上表現出顯著效果，但需針對學生的不同背景和自我統合程度進行調整，避免因活動設計不當而削弱學習成效。
6. 持續追蹤學生學習歷程：定期進行學習成效評估與反饋，通過問卷調查、訪談與學習數據分析，了解學生的實際需求與困難，並據此調整教學策略。

Woman Hold up Half the Sky! Exploring the Influence of Different Gender CEO Endorsements in Advertising

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Abstract

In the current advertising field, there is a noticeable imbalance between the number of male and female CEOs featured as endorsers. This disparity prompts reflection on whether gender stereotypes are influencing the gender ratio of CEO endorsers in advertising. Furthermore, the combination of an endorser's facial expression and the type of product endorsed plays a critical role in advertising effectiveness. This study proposes that under suitable advertising conditions, female CEOs can also generate positive advertising outcomes. Grounded in the concepts of gender stereotypes and the dimensions of social judgment, this research aims to explore whether featuring CEOs of different genders as endorsers—combined with varying smile intensities and product types—can lead to a better fit in consumers' perceptions of warmth and competence, thereby enhancing advertising effectiveness.

The findings reveal that the gender of the CEO endorser influences consumers' perceptions of warmth and competence to different extents. Specifically, female CEOs paired with a “smile” (as opposed to a broad smile) were perceived as having a higher level of competence than their male counterparts. When product type was introduced, the three-way interaction among CEO gender, smile intensity, and product type showed no significant effects on warmth or competence. However, further analysis of the simple main effects revealed that when the product was hedonic in nature, male endorsers—regardless of smile intensity—were perceived as warmer than female endorsers. Finally, the study confirms that higher consumer perceptions of an endorser's warmth and competence lead to more favorable advertising outcomes, supporting the importance of these two dimensions in driving advertising effectiveness. These findings offer practical insights for companies in designing CEO endorsement strategies and provide a foundation for future academic research.

Keywords: CEO endorser, social judgment dimension, sex stereotypes, product type, smile intensity

巾幗不讓鬚眉！探討不同性別 CEO 廣告代言之影響機制

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摘要

就廣告現況而言，男性 CEO 代言人與女性 CEO 代言人比例懸殊，令人不禁反思是否因受性別刻板印象的框架下，而造成 CEO 廣告代言人性別比例上的落差？此外，在廣告代言人的面部表情及代言的產品類型組合搭配上與廣告效果息息相關，因此本研究認為若在適當的廣告條件搭配組合下，女性 CEO 亦能擁有正面的廣告效果。故本研究基於性別刻板印象及社會判斷維度的概念，欲探討加入不同性別 CEO 廣告代言人是否會因笑容強度與產品類型不同組合，使消費者在溫暖及能力維度的感受上達成適配，進而擁有較佳的廣告效果。

本研究結果發現，CEO 廣告代言人性別會使消費者產生不同程度的溫暖及能力維度，而女性 CEO 代言人在搭配「微笑」時，相較於男性擁有較高程度的能力維度。此外，再加入產品類型後，三階適配對溫暖及能力維度皆無顯著交互作用，進一步進行單純主要效果分析後發現，惟當產品為「享樂品」時，男性不論搭配微笑或燦笑皆比女性擁有較高的溫暖維度。最後，當消費者對廣告代言人的溫暖及能力維度感知程度越高，則可擁有較佳的廣告效果，證實溫暖及能力維度會影響廣告效果。本研究結果可提供後續企業 CEO 廣告代言人廣告實務操作以及學術研究上能進一步探討並有所幫助。

關鍵字：CEO 廣告代言人、社會判斷維度、性別刻板印象、產品類型、笑容強度

壹、緒論

一、研究背景與動機

近幾年來，觀察到企業 CEO 有逐漸開始從幕後走到幕前替自家產品進行代言的趨勢，過往大部分企業傾向於使用名人作為廣告代言人主因，莫過於期望透過其名氣來吸引消費者目光與提升品牌知名度，惟居高不下的代言費用，使得許多企業望之卻步，也因如此，CEO 代言人成為了企業代言人選擇上的新寵兒。

隨著女性意識抬頭及社會風轉變，性別平等成為大家相當關注的議題之一，惟就 CEO 廣告代言人於實務面所觀察到，CEO 廣告代言人皆屬男性居多，而造成此現象之原因是否基於男性給人的性別刻板印象常與「專業」、「權力」等特質連結(Abele, 2003; Eagly et al., 2000; Heilman, 2012)，加上普遍廣告對於女性常以家庭主婦等角色進行描繪，鮮少以經理人等專業角色出現(Reichert & Carpenter, 2004)，因此使企業為了呈現品牌專業形象，認為使用男性作為代言人相較女性來得更具說服力？回顧 CEO 代言人相關研究，多著墨於代言人個人特質及可信度等，鮮少針對性別加以討論，故本研究將針對 CEO 代言人的性別進行探討。

刻板印象內容模型(Stereotype Content Model ; SCM)即以社會判斷維度作為基礎，分別為能力維度(以自我為導向)及溫暖維度(以他人為導向)所組成(Abele et al., 2008; Fiske et al., 2002; Judd et al., 2005)，我們可利用能力維度及溫暖維度來評估個體或群體(Fiske et al., 2002; Roy & Naidoo, 2021)，在傳統性別刻板印象上，可歸納出男性之性別刻板印象多圍繞於能力維度上，女性之性別刻板印象則以溫暖維度為主軸(Rudman et al., 2007)，由過往相關研究可得知，不論是性別刻板印象、職業刻板印象亦或是在消費者對企業和品牌的看法，人們皆會受到社會判斷維度的影響。因此，本研究旨在探討不同性別 CEO 廣告代言人是否會因為性別刻板印象的框架而左右消費者在能力維度及溫暖維度上的評斷，進而影響購買意願及廣告效果。此外，在廣告行銷上，廣告代言人的面部表情及其所代言的產品類型皆也會間接影響消費者的購買意願，Kulczynski et al. (2016)在代言人研究中發現，面帶笑容的表情會使消費者感覺更愉悅，進而對代言人及廣告態度、品牌態度產生正面情緒性的回應(Berg et al., 2015)。鑑此，本研究基於性別刻板印象及社會判斷維度的概念，欲探討加入不同性別 CEO 廣告代言人是否會因笑容強度與產品類型不同組合，使消費者在溫暖及能力維度的感受上達成適配，進而

擁有較佳的廣告效果。

貳、文獻回顧與假說推論

一、CEO 廣告代言人對於溫暖及能力維度之效果：

在品牌形象的建立上，CEO 廣告代言人相較於其他代言人類型更能增強消費者與企業之關係、購買意願(Dávila & Trendel, 2010)及提升品牌忠誠度等效果(Fetscherin, 2015; Men & Tsai, 2016)。此外，由於廣告時間通常相當短暫，人們習慣以既有的思維去看待及判斷人事物(林吟謙, 2021)，主要透過感知他人溫暖維度(以他人為導向)和能力維度(以自我為導向)的多寡來進行判斷(Fiske et al., 2007; Fiske et al., 2002)。溫暖維度主要傳遞溫暖、親切等感知；能力維度則傳遞專業、能力及權力等感知(Fiske et al., 2007; Fiske et al., 2002)所以多數廠商主要以社會普遍認知的思維來進行廣告文案的設計，藉以符合消費者對於性別印象的普遍認知((Davis, 2003; Jones & Reid, 2010)，進而達到廣告說服之目的(Ellemers, 2018)。在過往性別刻板印象研究中，女性通常被視為溫暖但不具備能力等特質，所以擁有較高程度的溫暖維度，而在能力維度上較低(Eagly & Karau, 2002)，反觀男性因被視為較具有能力及野心，不適合表現出過多的溫暖維度特徵。

綜合以上特性，本研究推論透過性別刻板印象及性別角色的框架下，男性 CEO 廣告代言人因其能力、專業等刻板印象，相較於女性 CEO，擁有較高程度的能力維度；而女性 CEO 代言人之溫暖、溫柔等刻板印象，相較於男性 CEO，擁有較高程度的溫暖維度。根據上述參考文獻，本研究提出以下假說：

H1a：男性 CEO 廣告代言人(相較女性 CEO 廣告代言人)擁有較高程度的能力維度。

H1b：女性 CEO 廣告代言人(相較男性 CEO 廣告代言人)擁有較高程度的溫暖維度。

二、笑容強度之適配效果

在行銷實務上，廣告代言人之面部表情、外表特徵會影響消費者對其品牌的評價(Bower & Landreth, 2001)，Mehu et al. (2007)研究指出，相較其他如悲傷、氣憤的面部表情，笑容更可吸引消費者的注意。

然而，廣告代言人隨著不同的笑容強度，帶給消費者的感受也會有所變化，Wang et al. (2017)其研究就以 Fiske et al. (2002)所提出的刻板內容模型(stereotype

content model, SCM)來區分笑容的強度，並以模型中的溫暖(warmth)判斷維度與能力(competence)判斷維度來劃分燦笑及微笑兩種笑容強度，燦笑所傳遞之效果給人較為親近、溫暖(Wang et al., 2017)，故會產生溫暖的認知感受，惟相對也給人較不好勝及追求權力地位等感受，使人進而聯想產生較無能力、低侵略感等印象，(Dabbs, 1997; Kraus & Chen, 2013)。反之，微笑則會使人產生如效率、成熟、聰穎等能力維度感受。

根據 H1 的推論，在廣告中使用男性 CEO 廣告代言人會給人擁有較高程度的能力維度，若同時搭配微笑之笑容強度，在同樣給人能力、聰穎等感受下，更能強化能力維度；而女性 CEO 則與溫暖維度多作連結，像是溫柔、親切等特質，在搭配給人同樣溫暖感受的燦笑之笑容強度，將強化溫暖維度。故根據上述之文獻，本研究提出以下之假說：

H2a：男性 CEO 廣告代言人搭配微笑時，相較於女性 CEO 廣告代言人擁有更高层次的能力維度。

H2b：女性 CEO 廣告代言人搭配燦笑時，相較於男性 CEO 廣告代言人擁有更高层次的溫暖維度。

三、產品類型對於 CEO 廣告代言人與溫暖及能力維度之適配效果

消費者的購買行為根據 Babin et al. (1994)的研究可區分為享樂型(hedonic)消費及功能型(utilitarian)消費兩種，從功能型消費，通常都是為了解決問題而購買產品以滿足功能性需求的慾望(Kang & Park-Poaps, 2010)；反觀享樂型消費則著重在購買產品後心理上的感受。Batra and Ahtola (1991)及 Dhar and Wertenbroch (2000)將相同的概念延伸至產品及服務面，將產品類型區分為功能品及享樂品。

功能品以滿足消費者功能性需求的形式呈現，即具備任務導向、功能性及理性等特性(Batra & Ahtola, 1991)；享樂品則以享受形式呈現，並能帶給消費者感官上的刺激或是情感上愉悅的潛力(Chaudhuri & Holbrook, 2001)，其屬性皆具有愉悅的(delight)、有趣的(fun)的特性(Voss et al., 2003)，綜合上述對於功能品及享樂品之定義，我們可歸納出功能品即是具備理性、功能面的特性，而享樂品則多與情感方面等特性有關。

而根據前述 H1 的假說推論，Aaker et al. (2012)研究也將能力維度及溫暖維度之概念應用於產品類別上，故若當其代言產品類型為功能品時，同樣受性別刻

板印象影響，男性 CEO 代言人即給人能力等特質若加上代言產品為功能品時，更能強化能力維度；反之，女性 CEO 廣告代言人多與溫暖、情感面相關的特質有關，給人較高程度的溫暖維度，故當其代言產品類型為享樂品時，更能強化溫暖維度。綜合上述文獻，本研究提出以下之假設：

H3a：男性 CEO 廣告代言人搭配功能品時，相較於女性 CEO 擁有更高程度的能力維度。

H3b：女性 CEO 廣告代言人搭配享樂品時，相較於男性 CEO 擁有更高程度的溫暖維度。

四、溫暖與能力維度對於 CEO 廣告代言人廣告之中介效果

廣告代言人在塑造企業品牌形象的過程中扮演著關鍵性的角色，根據 Dávila and Trendel (2010) 研究，CEO 廣告代言人更能增強消費者與企業之間的關係以及購買意願等，同時也具有提升品牌忠誠度之效果。

有鑒於消費者觀看廣告秒數日趨下降，使得消費者習慣透過既有的思維去看待及判斷人事物(林吟謙, 2021)，主要以感知他人溫暖維度及能力維度兩大面向來進行快速判斷(Fiske et al., 2007; Fiske et al., 2002)。

故不論是選擇男性或是女性 CEO 作為廣告代言人，消費者大多會透過既有的性別刻板印象來進行判斷，如男性多與有能力的、專業等能力特徵相關聯，相較於女性，會擁有較高程度的能力維度，在廣告文案設計上，就會以男性 CEO 廣告代言人有能力的设计文案來呈現。即便隨著時間流逝，性別刻板印象仍然存在著，大多數廠商仍選擇以社會普遍認知的思維來進行廣告文案的設計，藉以符合消費者對於性別印象的普遍認知(Davis, 2003; Jones & Reid, 2010)，使消費者對於廣告不同性別的代言人所扮演的角色產生認同，進而達到廣告說服之目的(Ellemers, 2018)。故綜合上述文獻，本研究提出以下假設：

H4a：男性 CEO 廣告代言人會透過能力維度影響廣告效果。

H4b：女性 CEO 廣告代言人會透過溫暖維度影響廣告效果。

本研究旨在探討廣告中使用 CEO 作為廣告代言人（男性 vs 女性），在透過（能力 vs 溫暖）的維度情況下，進而影響消費者的廣告態度、產品態度和購買意願，以及當 CEO 廣告代言人於廣告中搭配不同的笑容強度（微笑 vs 燦笑）與產品類型（功能品 vs 享樂品），是否會對溫暖維度及能力維度產生干擾。研究架

構如圖 1 所示：

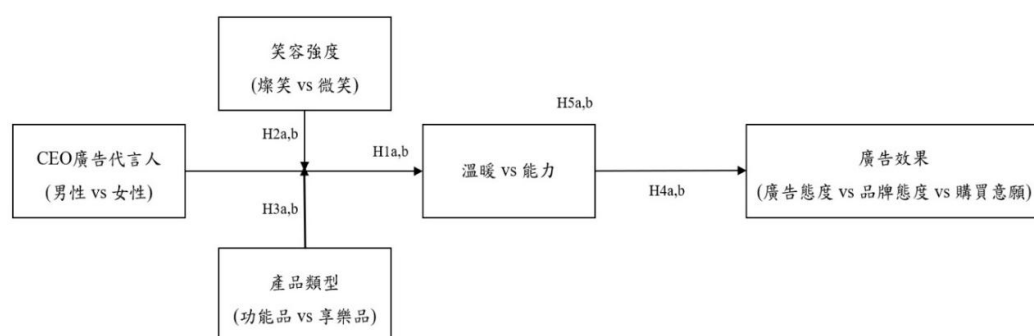


圖 1 研究架構圖

參、 實驗一

1. 實驗設計

本研究實驗一設計採用 2 (CEO 廣告代言人：男性 vs. 女性) x 2 (笑容強度：微笑 vs. 燦笑) x 2 (產品類型：功能品 vs. 享樂品) 三因子組間實驗設計，共有八種不同的實驗情境來進行驗證，採便利抽樣方式，共招募 485 名受測者參與本實驗。此實驗二加入產品類型藉以了解廣告中的產品類型是否會干擾不同性別 CEO 廣告代言人而使消費者對於溫暖及能力維度感知上的差異及後續廣告效果。

2. 變數衡量

本研究中欲衡量之變數主要為操弄性檢驗、中介變數、應變數、控制變數。操弄性檢驗為「笑容強度」，中介變數為「溫暖」、「能力」；應變數則分為三類，依序分別為「廣告態度」、「品牌態度」、「購買意願」；控制變數為「品牌熟悉度」，題項皆以李克特七點量表進行衡量。

3. 實驗一結果分析

(一) 研究樣本資料分析

本研究總計回收 643 份問卷，扣除填答不完全者與篩選題項，有效樣本為 485 份，受測者有效樣本共計 186 位男性、299 位女性，分別各佔總樣本數的 38.4%、61.6%，平均年齡為 36.14 歲(SD=9.32)。

(二) 變數之平均值、標準差及量表信度分析

本研究在信度分析方面，採用內部一致性檢定來檢驗量表信度。為確保實驗中所使用的題項衡量面向的一致性，故本研究採用 R studio 信度分析，以 Cronbach's α 係數進行說明。倘若 Cronbach's α 值達到 0.7 以上，則符合高信度水準(Nunnally & Bernstein, 1994)，而本研究各量表內部一致性介於 0.87 至 0.92 之間，可宣稱本研究所使用之量表皆具有良好的內在信度。

(三) 操弄性檢驗

為確保參與實驗一的受測者能夠認知到不同的笑容強度，故採用二因子 ANOVA 進行操弄性檢驗變數之驗證。而實驗主要刺激物為不同的笑容強度，以「微笑」、「燦笑」兩個不同形式操弄，分析結果可得知，以「微笑」作為依變數時，ANOVA 的結果顯示微笑情境的平均數(5.49)高於燦笑情境之平均數($M=3.60$, $F(1,476)=217.38$, $p<.001$)；反之，以「燦笑」作為依變數時，ANOVA 的結果顯示燦笑情境的平均數(5.38)高於微笑情境之平均數($M=3.18$, $F(1,476)=274.26$, $p<.001$)皆具顯著性差異，故可說明實驗之笑容強度操弄成功。

(四) 假說驗證

1. CEO 廣告代言人對於溫暖及能力維度之假說驗證

採用三因子 ANCOVA 分析不同性別 CEO 廣告代言人對於溫暖與能力維度之效果，並將品牌熟悉度此變數加以控制，各組平均數如表 1 所示。首先探討本實驗自變數之 CEO 廣告代言人性別對應變數部分，不同性別 CEO 廣告代言人對於能力維度並無顯著影響($F(1,476)=0.43$, $p=0.511$)，而本研究 H1a 提出男性 CEO 廣告代言人相較於女性 CEO 廣告代言人擁有較高程度的能力維度，惟 ANCOVA 的分析指出，男性 CEO 廣告代言人的能力維度平均數($M=5.01$)與女性 CEO 廣告代言人能力維度之平均數($M=4.97$, $F(1,476)=0.43$, $p=0.511$)並無顯著差異，故 H1a 不成立；另不同性別 CEO 廣告代言人對於溫暖維度則有顯著影響($F(1,476)=14.30$, $p<.001$)，而本研究 H1b 提出女性 CEO 廣告代言人相較於男性 CEO 廣告代言人擁有較高程度的溫暖維度，ANCOVA 的分析指出，男性 CEO 廣告代言人的溫暖維度($M=5.52$)要高於女性 CEO 廣告代言人($M=5.16$, $F(1,476)=14.30$, $p<.001$)，故 H1b 不成立。

表 1 三階交互作用之平均數與標準差

應變數	笑容強度	功能品		享樂品	
		男性	女性	男性	女性
能力維度	燦笑	n=60	n=61	n=61	n=60
		5.11(0.88)	4.84(1.05)	5.23(1.00)	5.10(0.78)
	微笑	n=62	n=57	n=63	n=61
		4.88(0.86)	4.92(1.05)	4.83(1.03)	5.04(1.06)
溫暖維度	燦笑	n=60	n=61	n=61	n=60
		5.42(0.88)	5.18(0.74)	5.85(0.81)	5.11(1.07)
	微笑	n=62	n=57	n=63	n=61
		5.39(0.94)	5.03(1.01)	5.44(0.86)	5.31(0.89)

2. CEO 廣告代言人與笑容強度對於溫暖與能力維度交互效果驗證

當應變數為「能力維度」時，不同性別 CEO 廣告代言人與笑容強度在二階交互作用($F(1,476)=3.82, p=0.051$)達邊際顯著，但為更深入了解笑容強度的干擾作用，故進行單純主要效果檢驗。根據下表 2 可以發現，當使用笑容強度為「微笑」時，女性 CEO 廣告代言人相較於男性 CEO 廣告代言人在能力維度上邊際顯著(M 男性=4.85 vs. M 女性=5.06, $t(476)=-1.84, p=0.066$)；而使用笑容強度為「燦笑」時，男性 CEO 廣告代言人與女性 CEO 廣告代言人在能力維度的程度上並無顯著差異(M 男性=5.09 vs. M 女性=4.98 $t(476)=0.92, p=0.356$)，而本研究假說 H2a：男性 CEO 廣告代言人搭配微笑時，相較於女性 CEO 廣告代言人擁有更高程度的能力維度，則 H2a 假說不成立。

當應變數為「溫暖維度」時，笑容強度與不同性別 CEO 廣告代言人則不具二階交互作用($F(1,476)=0.03, p=0.858$)，當使用笑容強度為「微笑」時，男性 CEO 廣告代言人相較於女性 CEO 廣告代言人擁有較高程度的溫暖維度(M 男性=5.41 vs. M 女性=5.14, $t(476)=2.56, p<.05$)；而在使用笑容強度為「燦笑」時，男性 CEO 廣告代言人相較於女性 CEO 廣告代言人擁有高程度的溫暖維度(M 男性=5.56 vs. M 女性=5.25, $t(476)=2.81, p<.01$)。綜合前述可得知，不論所使用的笑容強度為「燦笑」或是「微笑」時，男性 CEO 廣告代言人相較於女性代言人擁有較高程度的溫暖維度，而本研究假說 H2b：女性 CEO 廣告代言人搭配燦笑時，相較於男性

CEO 廣告代言人擁有更高程度的溫暖維度，故 H2b 假說不成立。

表 2 實驗一之單純主要效果（CEO 廣告代言人性別與笑容強度）

應變數	笑容強度	性別	平均差異 (男性-女性)	標準誤差	t	p 值
能力維度	微笑	男性 vs 女性	-.21	.11	-1.84	.066
	燦笑	男性 vs 女性	.11	.11	.92	.356
溫暖維度	微笑	男性 vs 女性	.28	.11	2.56	.011
	燦笑	男性 vs 女性	.30	.11	2.81	.005

3. CEO 廣告代言人與笑容強度對於溫暖與能力維度交互效果驗證

當應變數為「能力維度」時，產品類型與不同性別 CEO 廣告代言人不存在二階交互作用($F(1,476)=0.69, p=0.407$)，為更深入了解產品類型干擾作用，故進行單純主要效果檢驗。根據下表 5-5 事後檢定可以發現，當搭配產品類型為「功能品」時，男性 CEO 廣告代言人與女性 CEO 廣告代言人在能力維度上並無顯著差異(M 男性=5.00 vs. M 女性=4.98, $t(476)=0.13, p=0.894$)；而在使用產品類型為「享樂品」時，男性 CEO 廣告代言人與女性 CEO 代言人在能力維度上亦無顯著差異(M 男性=4.94 vs. M 女性=5.06, $t(476)=-1.08, p=0.281$)，而本研究假說 H3a：男性 CEO 廣告代言人搭配功能品時，相較於女性 CEO 擁有更高程度的能力維度，則 H3a 假說不成立。

當應變數為「溫暖維度」時，產品類型與不同性別 CEO 廣告代言人亦不存在二階交互作用($F(1,476)=1.07, p=0.302$)，當搭配產品類型為「功能品」時，男性 CEO 廣告代言人相較於女性 CEO 廣告代言人在溫暖維度上達邊際顯著(M 男性=5.40 vs. M 女性=5.20, $t(476)=1.92, p=0.055$)；而在使用產品類型為「享樂品」時，男性 CEO 廣告代言人相較於女性 CEO 代言人擁有較高程度的溫暖維度(M 男性=5.56 vs. M 女性=5.20, $t(476)=3.40, p<.01$)，而本研究假說 H3b：女性 CEO 廣告代言人搭配享樂品時，相較於男性 CEO 擁有更高程度的溫暖維度，則 H3b 假說不成立。

當應變數為「能力維度」時，笑容強度、產品類型及 CEO 廣告代言人三者間不具三階交互作用($F(1,476)=0.15, p=0.697$)，且可從表 5-6 單純主要效果分析中發現，三者之間的搭配皆無顯著效果；應變數為「溫暖維度」時，笑容強度、產品類型及 CEO 廣告代言人三者間亦不具三階交互作用($F(1,476)=0.42, p=0.516$)，惟在單純主要效果分析中，可發現當產品類型為享樂品時，男性 CEO 代言人搭配微笑(M 男性=5.40 vs. M 女性=5.10, $t(476)=2.03, p<.05$)或是搭配燦笑(M 男性=5.73 vs. M 女性=5.30, $t(476)=2.83, p<.01$)相較於女性 CEO 廣告代言人擁有較高程度的溫暖維度。

表 3 實驗一之單純主要效果 (CEO 廣告代言人性別與產品類型)

應變數	產品類型	性別	平均差異 (男性-女性)	標準誤差	t	p 值
能力維度	功能品	男性 vs 女性	.02	.12	.13	.894
	享樂品	男性 vs 女性	-.12	.11	-1.08	.281
溫暖維度	功能品	男性 vs 女性	.21	.11	1.92	.055
	享樂品	男性 vs 女性	.36	.11	3.40	.001

表 4 實驗一之單純主要效果
(CEO 廣告代言人性別與笑容強度、產品類型)

應變數	笑容強度	產品類型	性別	平均差異 (男性-女性)	標準誤差	t	p 值
能力維度	微笑	功能品	男性 vs 女性	-.18	.16	-1.07	.283
		享樂品		-.25	.16	-1.55	.123
	燦笑	功能品	男性 vs 女性	.20	.16	1.26	.210
		享樂品		.01	.16	.04	.971
溫暖維度	微笑	功能品	男性 vs 女性	.25	.15	1.60	.110
		享樂品		.30	.15	2.03	.043
	燦笑	功能品	男性 vs 女性	.17	.15	1.15	.252
		享樂品		.43	.15	2.83	.005

4. CEO 廣告代言人與笑容強度對於溫暖與能力維度交互效果驗證

本研究實驗二於中介效果驗證部分，採用 Hayes Process model 4 以拔靴法 (Bootstrapping) 進行 10,000 次重複抽樣，藉以檢驗溫暖維度與能力維度對廣告效果的影響。本研究以「男性」CEO 廣告代言人作為比較組，將「男性」CEO 廣告代言人編碼成「1」，「女性」CEO 廣告代言人編碼成「0」的虛擬變數，並加入品牌熟悉度作為共變數，並以 95%信心水準進行後續的中介效果分析。在中介效果驗證方面，可由表 5-9 的分析可得知，當應變數為廣告態度、品牌態度、購買意願之情況下，能力維度皆不具間接效果(廣告態度($\beta=-0.03, SE=0.04, CI=[-0.11, 0.05]$)、品牌態度($\beta=-0.03, SE=0.04, CI=[-0.10, 0.05]$)、購買意願($\beta=-0.03, SE=0.04, CI=[-0.11, 0.05]$))，證實 CEO 廣告代言人不會透過能力維度影響廣告態度、品牌態度、購買意願，故本研究 H4a：男性 CEO 廣告代言人會透過能力維度影響廣告效果之假說不成立；而在中介變數為溫暖維度時，應變數為廣告態度、品牌態度、購買意願之情況下，溫暖維度具有間接效果(廣告效果($\beta=0.19, SE=0.05, CI=[0.09, 0.29]$)、品牌態度($\beta=0.15, SE=0.04, CI=[0.07, 0.24]$)、購買意願($\beta=0.16, SE=0.04, CI=[0.08, 0.25]$))，證實 CEO 廣告代言人會透過溫暖維度影

響廣告態度、品牌態度、購買意願，且男性 CEO 廣告代言人會透過溫暖維度影響廣告效果($\beta=0.29, SE=0.08, CI=[0.14, 0.44]$)，故本研究 H4b：女性 CEO 廣告代言人會透過溫暖維度影響廣告效果之假說不成立。

肆、 結論與建議

一. 主要研究發現與討論

(一) CEO 廣告代言人性別會使消費者產生不同程度的溫暖及能力維度

實驗一在實驗設計上，代言人衣著上穿著休閒 T 恤，如前述所提及，男性本身即給人較有能力的刻板印象，即便脫去西裝，在能力維度上並無太大的影響，反而提高給人溫暖的感覺，故在溫暖維度上，男性相較於女性擁有較高程度的溫暖維度；反之，女性在沒有西裝的襯托下，削弱了給人能力的感知，而本身因性別刻板印象關係，溫暖方面則無太大的影響，故 H1 不成立，與原推論假說不一致。

(二) 笑容強度會干擾消費者對 CEO 廣告代言人溫暖及能力維度的感知

從實驗一的共變數分析的數據可得知，僅在能力維度時，笑容強度與 CEO 廣告代言人具有交互作用，再根據實驗二單純主要效果分析，當 CEO 廣告代言人為「女性」時，搭配「微笑」之笑容強度相較於男性會擁有較高的能力維度；而在溫暖維度時，雖笑容與代言人不具有交互作用，但當代言人為「男性」時，不論搭配微笑或燦笑之笑容強度皆相較於女性擁有較高程度的溫暖維度，故與原推論假說不一致，H2 不成立。

本研究推測在「燦笑」之笑容強度即給人較溫暖的感知，受到性別刻板印象所影響，女性普遍於廣告中皆以燦笑呈現且給人溫暖之特質，故女性 CEO 代言人搭配「燦笑」時，相較於男性會擁有較高程度的溫暖維度。而實驗結果發現女性 CEO 代言人在外貌上相較於實驗一給人較成熟的感覺，故在搭配同樣具有成熟、能力感受的「微笑」時會使消費者對其形象較有一致性，進而提升其能力的感知程度，相較於男性會擁有較高的能力維度。而在溫暖維度方面，男性 CEO 廣告代言人則因脫去西裝襯托後，提高了其溫暖維度上的感知，故不論搭配「燦笑」或「微笑」相較於女性代言人擁有高程度的溫暖感知。

(三) 產品類型不會干擾消費者 CEO 廣告代言人對溫暖及能力維度的感知

從實驗數據得知，產品類型不論是功能品或是享樂品與廣告代言人不存在交互作用，進一步單純主效果分析中觀察到，在溫暖維度時，當 CEO 廣告代言人「男性」，不論是搭配功能品或是享樂品相較於女性 CEO 廣告代言人擁有較高程度的溫暖維度；在能力維度時，男性或女性代言人不論搭配功能品或享樂品則皆無差異，故 H3 不成立。

此外，雖在產品類型、笑容強度及廣告代言人三階部分亦無交互作用，但透過三階單純主效果分析數據中發現，當產品類型為「享樂品」時，男性 CEO 廣告代言人不論搭配微笑或燦笑皆比女性 CEO 廣告代言人擁有較高程度的溫暖維度。本研究推測在實驗中，男性 CEO 廣告代言人衣著為休閒 T 恤，透過休閒穿搭，削弱原性別刻板印象給人權威感的感知，因而在溫暖感知上提升，故不論搭配何種產品及笑容強度皆比女性擁有較高的溫暖維度。

(四) CEO 廣告代言人的廣告效果會透過溫暖及能力維度部分中介

綜觀實驗一的結果，皆與原推論之假說 H4 相反，故 H4 不成立。本研究推測在實驗一中，男性因性別刻板印象雖在能力感知上無明顯變化，但也因休閒服飾的關係，弱化了性別刻板印象的權威感，進而提高了消費者對其溫暖感知的程度。

二. 理論貢獻

(一) 填補過往 CEO 廣告代言人在行銷與廣告效果中的研究缺口，並證實透過性別的組合與溫暖及能力維度相互搭配能有最佳的廣告效果，拓展 CEO 廣告代言人在行銷領域的運用。

Chi et al. (2009)研究指出，使用廣告代言人是常見日常行銷策略，然而過去有關廣告代理人類型之研究多以名人代言及專家代言人居多，相較之下，CEO 廣告代言人的相關行銷研究則較為缺乏，且現有研究則以可信度及個人特質(黃琬晴, 2015)等變數進行探討是否會影響廣告效果呈現，而鮮少針對 CEO 的性別進一步探討，是否會因性別的不同而具有不同的廣告效果。本研究即從另一構面切入，以具有脈絡之邏輯進行推論，利用性別刻板印象的概念來推論不同性別 CEO 廣告代言人如何在不同廣告情境下與溫暖及能力兩種不同維度相互搭配，使消費者對於廣告不同性別的代言人所扮演的角色產生認同的同時，達到廣告說

服之目的(Ellemers, 2018)，進而產生較佳的廣告效果。

(二) 搭配不同笑容強度，探討對 CEO 廣告代言人與溫暖及能力維度的干擾效果了解。

當人們在面對新認識的人事物時，為了在短時間內，快速理解他人，習慣以既有的思維去看待及判斷人事物(林吟謙, 2021)，意即所謂的「刻板印象」，而刻板印象涵蓋的範疇相當廣泛，包括性別、政治、宗教等，其中性別刻板印象與我們生活息息相關，像是普遍大眾對於男性的性別刻板印象多半被圍繞在具備能力的、權位性的能力維度面；女性則多與溫暖、親切、溫柔且注重家庭生活上(Paek et al., 2011)等以溫暖維度面為主軸。

根據過往研究顯示，代言人的面部表情會間接影響消費者購買意願(Kulczynski et al., 2016)，面帶笑容的表情會使消費者感受上更愉悅，進而對代言人、廣告態度及產品態度產生正面評價(Berg et al., 2015)，實務上常見的笑容強度可區分為微笑及燦笑，微笑使人產生如效率、成熟、有力量的、聰穎等感受，以能力維度為主軸，反觀燦笑所傳遞的感受較為親近、友善的、渴望建立社交關係的(Wang et al., 2017)，則以溫暖維度為主軸。

故本研究加入笑容強度作為干擾變數，探討以性別刻板印象之概念，不同性別 CEO 廣告代言人在搭配不同笑容強度時，研究結果顯示，笑容強度確實會強化或削弱消費者對於廣告代言人在溫暖與能力維度上的評斷，女性 CEO 廣告代言人雖然在性別刻板印象的影響下，搭配笑容強度會有較佳的廣告效果，但若加上服裝的設定如穿著西裝，使用微笑之笑容強度反而比男性代言人擁有較佳的廣告效果，希望以此提供未來企業在使用 CEO 廣告代言人廣告條件設定及規劃上之參考。

三. 實務貢獻

(一)打破性別刻板印象，女性 CEO 作為廣告代言人也能擁有亮眼的廣告效果

就目前廣告現況觀察到，CEO 作為廣告代言人系列廣告，皆以男性為主居多，鮮少看見女性 CEO 的蹤影，在男女比例如此懸殊下，令人不禁思考是否因為社會大眾對於 CEO 給人專業的、有能力的、權威的等職業刻板印象，加上男性給人的性別刻板印象亦是圍繞在有能力的、專業的等形容詞，進而影響企業在 CEO 廣告代言人性別上的選擇。而本研究結果發現，代言人衣著可強化消費者

對廣告代言人在能力及溫暖維度上的感知，若以「女性」作為 CEO 廣告代言人，雖然 CEO 職業刻板印象影響下，已帶給消費者一定的能力感知，但若要更加強化女性的能力感知，建議可透過俐落或專業感的服飾，搭配微笑或燦笑都相較於男性擁有較高程度的能力維度；「男性」CEO 廣告代言人受性別刻板印象所影響，則普遍給人較有能力的既定印象，故專業俐落的服飾類並不會對其能力感知有加分之效果，若想增添多一些溫暖的特質，建議可以搭配休閒服飾來柔化權威感的刻板印象。

同時，此發現也打破過往性別刻板印象，女性不再侷限以「燦笑」、「溫暖」的既定形象呈現於廣告中，才能擁有較佳的廣告效果，透過服裝及表情的搭配，女性也可擁有「能力」的幹練形象，廣告效果也並不亞於男性 CEO 廣告代言人。

(二)為企業提供更全面的 CEO 廣告代言人廣告設計之建議

承如上述所提及，因受到性別刻板印所影響，男性通常給人較有專業、能力的感覺，而女性則是溫暖、親切，因此在廣告元素的設計上有所限制，加上近年來政府也致力於提倡性別平等議題，故不同性別 CEO 廣告代言人如何搭配廣告元素進而達到最佳的廣告效果對企業來說甚為重要。本研究利用不同笑容強度及產品類型進行搭配，探討其之間的試配性，以提供企業在設計廣告告元素時，能根據不同的情境搭配最適合的組合，期所帶來較高程度的溫暖及能力維度進而影響廣告效果，為企業帶來更多商機。本研究結果提供企業以下建議：

本研究在產品類型與 CEO 廣告代言人在適配度上並無顯著影響，故企業不需因不同性別的 CEO 廣告代言人而侷限在產品類型上的搭配，但若代言產品為「享樂品」時，本研究根據結果建議男性搭配微笑或燦笑，再搭配休閒服飾是去強化溫暖的感知，進而擁有較佳的廣告效果，以提供企業在實務上做參考。

綜觀本研究結果可得知，在女性 CEO 廣告代言人在搭配適當的廣告元素組合下，亦能擁有正面的廣告效果，以提供行銷人員決策時參考，同時期望透過本研究，協助企業邁向及落實永續發展動「2030 永續發展目標」(Sustainable Development Goals, SDGs)「實現性別平等，並賦予婦女權力」，讓 CEO 廣告代言人不在僅限於男性作為主角。

四. 研究限制與未來方向

(一) 受限於預算支出成本及技術方面的限制，實驗一的廣告操弄皆以平面圖片為主，而非以動態影音進行廣告，因此整體廣告氛圍及情節可能影響受測者對 CEO 廣告代言人的認知。故未來研究建議可以實際以動態影音的方式提供受測者觀賞，以更符合真實電視廣告所呈現的一致性。

(二) 本研究在實驗一所選用產品為較專業之產品，廣告中文案應針對其功能較詳細的介紹，但礙於平面廣告篇幅及避免受測者接收過多資訊而失焦，故在產品推薦的內容中僅以簡單的文字「新品上市」帶過，因此受測者在未有獲得充分產品資訊的情況下，可能也會影響其購買意願。故未來之研究可考慮結合前述第一點之研究限制，在廣告文案上能針對產品特性多些著墨，以更符合實際情況，以利後續在實驗過程中更有效的衡量。

(三) 本研究在實驗中僅用「品牌 CEO」來揭露代言人身分，但對於受測者是否充分對「CEO」高階經理人的定義有所了解，亦可能影響填測結果，進而影響其購買意願，故在未來在針對 CEO 廣告代言人相關研究時，需將 CEO 高階經理人之定義說明納入考量。

(四) 因本研究在 CEO 廣告代言人的性別操弄上僅分為女性和男性，並未在其服裝多加著墨，故建議未來研究可以納入「服裝」元素進研究中，更進一步探討代言人服裝和其他如笑容強度、產品類型的適配組合，會如何對溫暖及能力維度產生影響，進而影響消費者對其推薦產品的購買意願。

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A Research on the Virtual Art Exhibitions: An Application of Game Theory

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Abstract

The COVID-19 pandemic has accelerated the popularization of virtual exhibition activities, serving as a critical opportunity to promote the development of virtual art exhibitions and performances. Under the constraints on in-person events, presenting artworks online through digital technologies such as Virtual Reality (VR), Augmented Reality (AR), or Mixed Reality (MR) has become a key marketing strategy in the post-pandemic era.

Game Theory, originally applied in the economic domain to analyze the strategic interaction and outcomes among multiple decision-makers, has gradually expanded into the fields of social sciences, management, and engineering. Virtual art exhibitions also exhibit the game-like characteristics of multiple stakeholders: artists seek to enhance the exposure and commercial value of their works; curators strive to design engaging and profitable exhibitions within limited resources; technical teams focus on balancing technological costs and returns; while audiences expect high-quality experiences. Accordingly, this study integrates the Coordination Game in Game Theory with the case study method to analyze virtual art exhibitions. The cases examined are *Along the River During the Qingming Festival*, *Da Vinci Experience: Five Centuries of Brilliance*, and *Calligraphy Across Boundaries: A New Media Exhibition*. The objectives of this research, through the Coordination Game framework, are: (1) to analyze the strategic interactions among multiple stakeholders and elucidate the mechanism of value formation in virtual exhibitions; (2) to explore the dynamic mechanism of virtual art value and how the strategic actions of each party influence the assessment of artistic value; and (3) to offer theoretical and practical recommendations for curation and future development.

By applying the Coordination Game in conjunction with case studies, this research illustrates the strategic interplay and value construction processes among various participants in virtual art exhibitions. The findings can theoretically reinforce the feasibility of using Game Theory in the cultural and artistic domains, while practically providing new perspectives and strategic planning directions for exhibition curation and collaboration among stakeholders. Through continuous in-depth exploration and interdisciplinary research, it is anticipated that the future potential of virtual art exhibitions will broaden further, leading and shaping innovation and development in the art ecosystem of the post-pandemic era.

Keywords: Game Theory, Coordination Game, Virtual Exhibition Digital Technology, game, pandemic

賽局理論應用於虛擬藝術展演之研究

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摘要

新冠疫情(COVID-19)加速了虛擬展覽活動的普及，成為推動虛擬藝術展演發展的重要契機。在實體活動受限的情況下，透過虛擬實境(VR)、擴增實境(AR)或混合實境(MR)等數位科技，以線上形式展現藝術作品已成後疫情時代的關鍵行銷手法。

賽局理論(Game Theory)為一種分析多方決策者策略互動與行為結果的工具，原多應用於經濟領域，後逐漸擴及社會科學、管理學與工程等領域。虛擬藝術展演亦具備多方行為者的博弈特徵：藝術家期盼提高作品曝光與商業價值，策展方希望在有限資源下設計吸引且盈利的展演，技術團隊注重技術成本與回報，觀眾則期待高品質的體驗。故以賽局理論的協調賽局(Coordination Game)結合個案研究法應用於虛擬藝術展演之研究。案例為：〈會動的清明上河圖〉、〈達文西體驗展～超越500年的輝煌〉、〈揮翰學書—書法跨域新媒體展〉。研究的目的是透過協調賽局模型：1.分析多元行為者的策略互動關係，闡明虛擬展演價值形成機制。2.探究虛擬藝術價值之動態機制以及各方在策略行動中如何影響藝術價值評估。3.提供策劃與未來發展之理論與實務建議。

本研究運用協調賽局理論並結合個案研究法，說明多方行為者在虛擬藝術展演中的策略互動與價值建構過程。研究結果於理論上可強化賽局分析文化藝術領域的可行性，亦在實務上為展演策劃與多方利害關係協同提供了新思維與策略規劃方向。藉由持續深化並結合跨領域研究，相信虛擬藝術展演之未來潛能將更為寬廣，並引領後疫情時代藝術生態的創新與發展。

關鍵字：賽局理論、協調賽局、虛擬展演、數位科技、博弈、疫情

壹、緒論

隨著數位技術的迅速發展，虛擬現實（Virtual Reality, VR）、擴增實境（Augmented Reality, AR）及混合實境（Mixed Reality, MR）等技術的成熟，虛擬藝術展演逐漸成為當代藝術展示的重要形式。虛擬展演不僅突破傳統實體空間的限制，還提供多樣化的互動方式，觀眾可以在自由且沉浸的環境中體驗藝術，憑藉其靈活及跨時空的優勢實現全球化的藝術交流。

虛擬展演在技術層面雖日益成熟，但觀眾的參與程度會受到平台設計、內容吸引力與參與成本等多重因素影響。策展者則需在吸引觀眾、平衡資源投入與達成經濟效益之間做出權衡。在此背景下賽局理論提供了一個不同的視角，賽局理論又稱博弈論被視為同義詞，皆用以描述相同的數理與社會科學理論分支，亦可廣泛應用於藝術展演與策展規劃。從博弈的角度出發，協助藝術家、策展人與各利害關係人更系統性地思考「如何讓作品或展演在激烈競爭中脫穎而出」與「如何有效協同或差異化定位」，進一步促進整體藝術生態的發展。研究案例為：〈會動的清明上河圖〉、〈達文西體驗展—超越 500 年的輝煌〉、〈揮翰學書—書法跨域新媒體展〉，模擬不同策略情境下的博弈結果，分析最佳互動策略與效能。

一. 研究背景與動機

全球化與數位化的時代洪流中，各種產業邁入跨域發展，如：虛擬實境（VR）的應用，促使經典的藝術作品能更貼近民眾。數位技術的快速發展帶動虛擬藝術展演突破實體空間的限制，為藝術家、策展人和觀眾提供了全新的交流平台。新冠肺炎疫情（2020~2022）加速虛擬展覽的普及成為虛擬藝術展演的重要推手，在無法舉辦實體活動的情況下，透過虛擬實境（Virtual Reality, VR）、擴增實境（Augmented Reality, AR）等科技打造全新互動模式，是後疫情時代重要的行銷手法。如：博物館和畫廊通過數位平台舉辦線上展覽，模擬真實空間的觀看體驗。線上展覽和虛擬藝術的發展成了全球趨勢，傳統的實體展覽方式逐漸與數位技術相結合，挑戰虛擬載體的創作能量，開啟實體展演空間外的想像。

賽局又稱博弈論，是一門研究決策者之間策略互動及其結果的數學理論，作為分析多方參與者互動行為與策略選擇的工具，最初應用於經濟學，後來逐漸拓展至社會科學、管理學及工程學等多個領域。在有限資源或利益衝突時，參與者在競爭或合作情況下，如何作出最佳決策的過程。虛擬藝術展演的情境中，玩家

可以包括藝術家、策展人、觀眾及藝術市場中的其他利益相關者。透過賽局理論應用於虛擬藝術展演建立參與者（如策展者和觀眾）之間的博弈模型，分析參與者的行為選擇如何影響整體系統的結果。

二. 研究目的

探討賽局理論如何應用於虛擬藝術展演，包括：建構虛擬展演中策展者與觀眾之間的博弈模型，分析虛擬藝術展演之多元行為者策略互動關係，提出策略性建議。並以賽局理論中的協調賽局為基礎，案例分析為研究方法，建立策展者與觀眾之間的策略互動模型，虛擬藝術展演價值形成與評估的動態機制。透過對虛擬藝術展演及賽局模型的分析，為虛擬展演策劃與未來發展，提供理論基礎與實務策略建議。

貳、 文獻探討

一. 藝術展演

藝術展演（Art Exhibition）是指透過視覺、聲音、身體動作或其他媒介，將藝術作品或創作概念在特定情境下呈現與傳達，涵蓋多種形式和意涵。目的是與觀眾建立互動或情感連結的重要橋樑，可以是靜態展示（如畫展、雕塑展）或動態演出（如舞蹈、劇場表演）。隨著數位技術與網路傳播的興起，藝術展演不再局限於實體空間與時間，展演領域衍生出各種嶄新形態，如虛擬展覽(Virtual Exhibition)與沉浸式藝術體驗(Immersive Art Experience)，包含傳統美術館、藝廊中的實體展覽(Exhibition)、劇院舞台上的表演、大型藝術博覽會、多媒體裝置藝術以及結合新媒體與科技的混合型態展演。

二. 虛擬藝術

虛擬藝術（Virtual Art）是一種結合科技與創作的藝術形式，透過數位媒介與虛擬技術（如虛擬實境 Virtual Reality, VR、擴增實境 Augmented Reality, AR、混合實境 Mixed Reality, MR）進行創作與展示。在藝術領域，數位技術的發展不僅改變創作與展示的形式，也催生了新的藝術類型，利用計算機生成的虛擬環境，提供沉浸式的感官體驗，挑戰傳統藝術的形式與呈現方式。

三、賽局理論

(一) 賽局理論概述

賽局理論(Game Theory)是透過「玩遊戲」而獲得的人生競爭知識理論，又稱遊戲理論、博弈論、競局理論等，為策略性思考的系統邏輯方法，藉由系統性的思考方式來制定策略。賽局理論於1944年，由美國普林斯頓大學教授 John von Neumann 和 Oskar Morgenstern 合著《賽局理論與經濟行為》(Theory of Games and Economic Behavior)一書發展出來的零合賽局後，將賽局理論應用在經濟行為分析。直到1950年，由 John Nash 發展出零合賽局及提出一般性均衡，又稱「納許均衡」(Nash Equilibrium)後，賽局理論才得以發揚光大而成為顯學。Ho & Weigelt 以策略臍帶(Strategic)形容參賽者間的連帶互動關係，並指出賽局理論為有系統的研究方法，協助分析、預測競爭對手的策略行動。D.M.Kreps 亦指出賽局理論對經濟最偉大貢獻在於協助提出問題重心，提供策略模型有效解決應對的競爭問題。藉由推導以決定賽局參與者在理性追求自身利益的前提下，該採取何種決策？以及如此選擇會產生什麼結果（張宮熊，2017）。

(二) 賽局理論的基本元素

賽局理論主要是研究參賽者間策略行為(Strategic Behavior)互動的關係(Interaction)，故不同的賽局類型將產生不同的結果(梁文貴 1998)。

基本元素包括：

- 1.誰是參賽者(Player)
- 2.所有參賽者可以選擇的行動策略(Strategic)
- 3.所有參賽者的報酬函數(Utility)。

(三) 賽局理論的內涵與應用

賽局理論是一種策略的相互依存狀況，你的「選擇」即「策略」，將會得到什麼結果是取決於另一方有目的的參賽者之選擇，任何一場賽局，具有決策權的參賽者構成一個決策主體。賽局理論在邏輯推演亦是數學模式的衍生應用，其內涵為研究互動形式的決策模式。賽局的獨特之處在於利用簡單的遊戲規則(參賽者、訊息集、報酬函數、策略節點)以達到均衡的結果，對於賽局的最終結果(納許均衡)，雖非絕對理性或有效率，但卻能適切的貼近事實的現況，被廣泛應用於各個領域案例的模擬分析。如：企業間的價格競爭策略或商業談判等，部分學

者亦結合賽局理論應用之研究。(曾士朋, 2024; 蔡志鴻, 2023; 施家豪, 2023; 施易呈, 2023; 陳昕婕, 2020; 劉德勇, 2017; 張宮熊、蔡秀美, 2011; 許恆壽, 2009。)

參、 研究方法

本研究主要是透過「文獻整理」與「個案分析」, 蒐集相關資料、國內外專業書籍、期刊、網路資訊、學術論文等文獻作為理論的延伸, 藉由取得的資料與個案整理, 以賽局理論為分析框架, 探討展覽中的多方參與者(策展人、技術提供方、藝術家及觀眾)在資源分配與策略選擇中的行為互動, 分析展覽如何平衡創新性與商業效益, 並提出資源配置與合作優化的建議做為學術性探討。

協調賽局의核心理念是透過溝通採取合作共創「雙贏」。雙方的策略性互動行為(Interactive Behavior), 在一來一往間產生直接相互作用而影響決策。無論競爭或合作, 每個決策者的行動都會影響其他決策者的結果, 進而影響自身, 如何選擇成功率最高且最適當的方法或工具, 則為科學計算的策略式互動行為(Interactive Behavior)。

肆、 個案研究

策略賽局的本質在於參與者的決策相互依存, 以協調賽局(Coordination Game)的策略互動方式, 應用於個案一、〈會動的清明上河圖〉、個案二、〈達文西體驗展—超越 500 年的輝煌〉、個案三、〈揮翰學書—書法跨域新媒體展〉進行案例分析。以案例中的兩方行為者為對應關係, 並以一組策略選擇模擬該情境下, 賽局模型的架構與協調均衡(Coordination Equilibrium)的概念。

一、會動的清明上河圖

結合科技與藝術的創新形式, 通過數位技術和沉浸式媒體, 〈清明上河圖〉不再只是一幅長卷, 而是一個飽含景物、歷史、制度、生活樣貌和人物特色的說話人, 帶領人們從不同的角度來觀看與感受, 認識和理解當時的北宋。運用賽局理論分析虛擬藝術展演的互動模式, 探討其策展策略、觀眾參與行為及多方利益間的動態平衡。



〈會動的清明上河圖〉

展覽地點:華山 1914 文化創意產業園區

圖片來源:蔡竺芯拍攝

(一)個案簡介:〈會動的清明上河圖〉

〈清明上河圖〉為北宋末年汴京市井空間及人物活動描述，筆法非常細緻、生動、精妙的偉大畫卷，表現當時市井生活的代表作，由北宋畫家張擇端繪製於西元 1111~1120 年間。

1.特色說明:

以長卷形式採用散點透視的構圖法，生動記錄 12 世紀北宋都城汴京（今大陸河南開封）的城市面貌和各階層人民的生活實況。將繁雜的景物納入畫中，全幅場面浩大，內容豐富、構圖嚴謹、筆法細緻，被譽為宋代的小百科全書，兼具藝術、歷史與人文的精妙，充分表現畫家對社會生活的深刻洞察力和高超的藝術表現力。同時提供了北宋首都的商業、手工業、民俗、建築、交通等第一手資料，具有重要歷史文獻價值，其豐富的思想內涵在中國乃至世界繪畫史上被奉為經典之作。

2.展覽特點

- (1) 數位化與沉浸感：藝術展覽通過數位化技術賦予畫卷動態效果，河流、商船、行人等場景動態呈現，可融入真實與虛擬之間的場景中。
- (2) 高互動性：設有互動環節如探索場景故事或參與模擬宋代集市活動。
- (3) 教育與娛樂兼具：文史知識普及藝術觀賞價值，適合家庭、學校等多元族群。

(二)賽局資訊與基本假設

1.基本假設

(1) 參賽者:策展方 C 與技術團隊 T

(2) 資訊狀況: 完全、對稱、確定

- 完全:參賽者雙方皆為平台的創作者，在平台中雙方的資訊及影片為公開透明的，故屬於完全資訊。
- 對稱:因雙方皆了解平台之獲利模式及狀況故雙方資訊對稱。
- 確定:在雙方進行決策後，決策與報酬將不再進行更動，故雙方為確定。

2.賽局資訊

(1) 賽局模型運用:協調賽局

(2) 賽局分類:靜態賽局、非零和賽局

(三)賽局推演:

1.案例名稱:〈會動的清明上河圖〉

以北宋張擇端的名作〈清明上河圖〉透過數位動畫、動態投影與互動裝置重現古代生活百態。該展將傳統繪卷以虛擬方式詮釋，觀者可透過移動、自主視角選擇，進入情境化的歷史脈絡之中。案例中多方行為者需協調呈現技術與藝術詮釋標準，若策展方與技術團隊協調一致採用高端技術標準，觀眾體驗提升，各方得到最大整體收益；若協調失敗，則整體價值下滑。研究模式將透過策略矩陣呈現此協調問題，並顯示行為者在何種資訊傳遞與信號下可快速達成高品質均衡。

2.策略設定：協調賽局

(1) 策展方 C:高標準藝術詮釋(H)/低標準藝術詮釋(L)

(2) 技術團隊 T:高階技術(H)/基礎技術(L)

3.賽局方格:策展方 C 對技術團隊 T

表 4-1-1 賽局方格:策展方 C 對技術團隊 T

策展方 C	技術團隊 T		
		高階技術(H)	基礎技術(L)
	高詮釋(H)	$(\Theta + \lambda + \phi - u, \bar{U} + O + u - \phi)$	$(\Theta + \lambda + \phi, \bar{U} - \phi)$
	低詮釋(L)	$(\Theta - u, \bar{U} + O + u)$	$(\Theta, \bar{U})$

(四)函數說明：

1. (H,H)：雙方都採用高標準，高品質展演使觀眾體驗大幅提升，產生最大整體收益 $(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$ ，此為理想狀態的協調均衡。
2. (L,L)：雙方都採用低標準，雖不如(H,H)卓越，但因策略一致仍有穩定收益 $(\Theta, \bar{U})$ ，形成另一個協調均衡。
3. (H,L)或(L,H)不匹配時整體價值下滑，顯示不一致的策略組合降低成果。

此案例中，高品質均衡(H,H)為目標，研究模式可分析資訊傳遞機制（如事前溝通、技術標準訂立），如何引導雙方從(L,L)或不匹配狀態趨近(H,H)。

表 4-1-2 策展方 C 對技術團隊 T 之協調賽局

策展方 C	技術團隊 T		
		高階技術(H)	基礎技術(L)
	高詮釋(H)	$(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$	$(\Theta + \lambda + \phi, \bar{U} - \phi)$
	低詮釋(L)	$(\Theta - u, \bar{U} + \bar{O} + u)$	$(\Theta, \bar{U})$

假設策展方 C 之基礎報酬函數為 Θ ，技術團隊 T 為 $\bar{U}$ ，當雙方採 L 低詮釋與 L 低技術時，僅有基礎報酬 $(\Theta, \bar{U})$ ，而 λ 與 $\bar{O}$ 是在雙方選擇共同合作之情況下，兩方分別獲得之額外報酬 $(\lambda, \bar{O})$ ， ϕ 與 u 為人數流量報酬，當一方選擇高詮釋，另一方選擇低技術時，採高詮釋者因效果較佳，從對方吸取流量，因此獲得流量報酬 (λ, u) ，而另一方則因流量被取走而失去流量報酬，以下將詳細說明個案中創作者在不同決策下所獲得的報酬函數：

1. 策展方 C 與技術團隊 T 共同選擇高詮釋(H)與高技術(H) (合作)

當雙方決定要合作，共同選擇高技術(H)與高詮釋(H)的情況下，策展方 C 將獲得基礎報酬加上額外報酬以及因品質趨勢從對方身上獲取之流量 $(\Theta + \lambda + \phi)$ ，技術團隊 T 則獲得 $(\bar{U} + \bar{O} + u)$ ，但由於雙方選擇共同選擇高技術(H)與高詮釋(H) (合作)，兩方分因高品質效果所帶來的流量，報酬將會被互相抵銷，因此，最後報酬函數為 $(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$ 。

2. 策展方 C 選擇高詮釋(H)，技術團隊 T 選擇基礎技術(L)

在此情況下策展方 C 將獲得基礎報酬加上額外報酬以及因品質趨勢從技術團隊 T 身上獲取之流量($\Theta + \lambda + \phi$)，技術團隊 T 因選擇基礎技術(L)僅能獲得基礎報酬，以及被策展方 C 取得之流量，需扣減被取走的流量報酬，故最後技術團隊 T 之報酬函數為($\bar{U} - \phi$)。

3. 策展方 C 選擇低詮釋(L)，技術團隊 T 選擇高技術(H)

此情況策展方 C 由於選擇低詮釋(L)只能獲得基礎報酬，加上技術團隊 T 選擇高技術(H)，導致策展方 C 流量被取走，最後獲得的報酬函數需要扣掉流量報酬，最終策展方 C 之報酬函數為($\Theta - u$)，反之技術團隊 T 藉由高技術展示，除了獲得基礎報酬外又多獲得額外報酬，從策展方 C 身上獲取之流量報酬，故技術團隊 T 的報酬函數為($\bar{U} + \bar{O} + u$)。

4. 策展方 C 與技術團隊 T 皆選擇低詮釋(L)與基礎技術(L)

當雙方皆選擇低詮釋(L)與基礎技術(L)時，兩方皆沒有透過展演帶來額外的流量，也無法從對方身上獲取流量，因此雙方僅能獲得基礎報酬，故報酬函數為($\Theta, \bar{U}$)。

(五)管理意涵

當賽局有兩個或更多的納許均衡時，參賽者將難以抉擇，因每一個均衡都可能發生，雙方的行動均會影響到對方，必須透過各種協調或選擇來達到自己預期的目標，雙方若皆能在競爭市場獲得合理利益時，協調賽局則能透過各種協調行為來產生雙贏的局面。雙贏的合作哲學是為雙方找到平衡點，共同促成對雙方都有益的決策，並創造出合作的機會。

二、達文西體驗展～超越 500 年的輝煌

義大利畫家喬爾喬·瓦薩里(Giorgio Vasari)曾說過：「達文西無論在哪個領域都表現非常出眾，而且都以繪畫方式做呈現，內容也總令人感到驚豔。」對達文西而言，「繪畫」是一種研究和分析所見事物的方式，同時也是一種最直接、清楚且最有效率的溝通語言，在解剖學、機械、藝術、軍事工程等，都可發現他的研究手稿。

因此，繪畫可說是達文西在創作設計上的獨有表現，最可以清楚表達想法，將不同領域的知識結合在一起。本節以〈達文西體驗展～超越 500 年的輝煌〉為案例，探索虛擬藝術展演中的多方互動與策略選擇，結合賽局理論分析展演在策展、參與和資源分配上的決策模式。

(一)個案簡介:〈達文西體驗展～超越 500 年的輝煌〉



〈達文西體驗展—超越 500 年的輝煌〉

圖片來源: <https://www.elle.com/tw/life/style/g60612705/leonardo-da-vinci/>

1. 特色說明:延續〈再見梵谷〉震撼沉浸式光影體驗

延續〈再見梵谷—光影體驗展〉的震撼視覺效果，〈達文西體驗展〉由澳洲策展公司 Grande Experiences 開發的 SENSORY4™ 沉浸式投影系統，再度以五公尺巨幕環繞空間，透過光影呈現出〈蒙娜麗莎的微笑〉、〈最後的晚餐〉等經典作品，細膩的筆觸細節，讓觀眾有如親身穿梭在達文西天馬行空的異想世界。

除了沉浸式光影展示區外，〈達文西體驗展〉為全面解析這位絕世天才橫跨藝術、軍事、飛行器、解剖學、樂器等領域的前瞻奇想，更集合了超過 50 件由羅馬達文西博物館官方授權的珍貴實體展件，以多元化的展示內容，完整剖析這位天才藝術家的前瞻奇想。

2. 展覽特點

- (1) 多感官體驗:觀眾可以通過 VR 探索達文西的發明或“進入”《蒙娜麗莎》的世界。
- (2) 高互動性:參觀者可以操作達文西設計的機械模型，或通過數字屏了解其創作過程。

- (3) 教育與娛樂融合：展演兼具藝術啟蒙與科學教育價值，吸引家庭與學校群體。

(二)賽局資訊與基本假設

1.基本假設

(1) 參賽者:策展方 C 與觀眾 A

(2) 資訊狀況: 完全、對稱、確定

- 完全:參賽者雙方皆為展區的參與者，在展區中雙方的資訊為公開透明，故屬於完全資訊。
- 對稱:因雙方皆了解展區之狀況故雙方資訊對稱。
- 確定:在雙方進行決策後，決策與報酬將不再進行更動，故雙方為確定。

2.賽局資訊

(1) 賽局模型運用:協調賽局

(2) 賽局分類:靜態賽局、非零和賽局

(三)協調賽局推演:

1.案例名稱:〈達文西體驗展—超越 500 年的輝煌〉

將達文西畫作、手稿、機械發明透過沉浸式投影、擴增實境(AR)與虛擬實境(VR)情境重現，觀眾可以在虛擬場域中自由探索，同時協調多元感官體驗。此案例強調沉浸式體驗，策展方、技術團隊與觀眾的互動形成人為主導的共創空間：若策展方提供高沉浸度體驗，觀眾積極投入，則展覽影響力與價值最大化；若雙方策略不一致，則無法發揮作品深度。

案例強調沉浸式體驗，著重於策展方(C)與觀眾(A)之策略互動（實務中亦可將技術團隊納入分析）。高沉浸度策展若能配合觀眾深度參與，將達成最高價值。

2.策略設定：協調賽局

(1) 策展方 C：高沉浸度(H)/一般體驗(L)

(2) 觀眾 A：深度參與(D)/淺度瀏覽(N)

3. 賽局方格: 策展方 C 對觀眾 A

表 4-2-1 賽局方格: 策展方 C 對觀眾 A

策展方 C	觀眾 A		
		深度參與(D)	淺度瀏覽(N)
	高沉浸(H)	$(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$	$(\Theta + \lambda + \phi, \bar{U} - \phi)$
	低沉浸(L)	$(\Theta - u, \bar{U} + \bar{O} + u)$	$(\Theta, \bar{U})$

(四) 函數說明：

1. (H,D)：策展方 C 與觀眾 A 雙方都採高沉浸(H)和深度參與(D)觀眾體驗大幅提升，產生最大收益 $(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$ ，此為理想狀態的協調均衡。
2. (L,L)：若雙方都採用低沉浸(L)與淺度瀏覽(N)，效果雖不如(H,H)卓越，但因策略一致尚有穩定收益 $(\Theta, \bar{U})$ ，形成另一個協調均衡。
3. (H,N)或(L,D)不匹配時整體價值下滑，顯示不一致的策略組合降低成果。此案例中，高品質均衡(H,H)為目標，研究模式可分析資訊傳遞機制（如事前溝通、技術標準訂立），如何引導雙方從(L,L)或不匹配狀態趨近(H,H)。

研究模式可進一步資訊公開（展前預告、試看內容）、口碑傳播、定價策略（優惠入場券、深度導覽講解）如何促使觀眾 A 由淺度瀏覽(N)轉向深度參與(D)，並使策展方 C 願意長期投入高沉浸(H)，最終達成(H,D)的高價值協調均衡。

表 4-2-2 策展方 C 對觀眾 A 之協調賽局

策展方 C	觀眾 A		
		深度參與(D)	淺度瀏覽(N)
	高沉浸(H)	$(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$	$(\Theta + \lambda + \phi, \bar{U} - \phi)$
	低沉浸(L)	$(\Theta - u, \bar{U} + \bar{O} + u)$	$(\Theta, \bar{U})$

假設策展方 C 之基礎報酬函數為 Θ ，觀眾 A 為 $\bar{U}$ ，當雙方採低沉浸(L)與淺度瀏覽(N)時，僅有基礎報酬 $(\Theta, \bar{U})$ ，而 λ 與 $\bar{O}$ 是在雙方選擇共同合作之情況下，兩方分別獲得之額外報酬 $(\lambda, \bar{O})$ ， ϕ 與 u 為人數流量報酬，當策展方 C 選擇高沉浸(H)，觀眾 A 選擇淺度瀏覽(N)時，策展方 C 採高沉浸(H)效果較佳，轉從

對方觀眾 A 獲得客群流量，其流量報酬為 (λ, u) ，而另一方則因流量被取走而失去流量報酬，以下說明個案中創作者在不同決策下所獲得的報酬函數：

1. 策展方 C 與觀眾 A 共同選擇高沉浸(H)與深度參與(D)(合作)

當雙方決定要合作，共同選擇高沉浸(H)與深度參與(D)的情況，策展方 C 將獲得基礎報酬加上額外報酬以及從對方身上獲取之流量 $(\Theta + \lambda + \phi)$ ，觀眾 A 則獲得 $(\bar{U} + \bar{O} + u)$ ，但由於雙方選擇共同選擇高沉浸(H)與深度參與(D)(合作)，兩方因高品質效果所帶來的流量報酬將會被互相抵銷，因此最後報酬函數為 $(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$ 。

2. 策展方 C 選擇高沉浸(H)，觀眾 A 選擇淺度瀏覽(N)

此情況策展方 C 將獲得基礎報酬加上額外報酬及品質因素從觀眾 A 身上獲取之流量 $(\Theta + \lambda + \phi)$ ，觀眾 A 因選擇淺度瀏覽(N)僅能獲得基礎報酬，以及被策展方 C 取得之流量，需扣減被取走的流量報酬，故最後觀眾 A 之報酬函數為 $(\bar{U} - \phi)$ 。

3. 策展方 C 選擇低沉浸(L)，觀眾 A 選擇深度參與(D)

策展方 C 由於選擇低沉浸(L)只能獲得基礎報酬，加上觀眾 A 選擇深度參與(D)，導致策展方 C 流量被取走，最後獲得的報酬函數需要扣掉流量報酬，最終策展方 C 之報酬函數為 $(\Theta - u)$ ，而觀眾 A 選擇深度參與(D)，除了獲得基礎報酬外又多獲得額外報酬，從策展方 C 身上獲取之流量報酬，故觀眾 A 的報酬函數為 $(\bar{U} + \bar{O} + u)$ 。

4. 策展方 C 與觀眾 A 皆選擇低沉浸(L)與淺度瀏覽(N)

雙方皆選擇低沉浸(L)與淺度瀏覽(N)時，因雙方都沒有透過展演帶來額外的收穫，也無法從對方身上獲取流量，因此雙方僅能獲得基礎報酬，故報酬函數為 $(\Theta, \bar{U})$ 。

(五)管理意涵

當賽局有兩個或更多的納許均衡時，每一個均衡都可能發生，參賽者將難以抉擇，雙方的行動都會影響到對方，須透過各種協調或選擇來達到自己預期的目標進而產生雙贏。

三、揮翰學書—書法跨域新媒體展

書法為中國文化特有的藝術形式，其歷史與美學內涵深厚。隨著電腦及手機語音輸入使用的普遍，現代人手寫經驗愈來愈少，故宮南院〈揮翰學書〉書法跨域新媒體展結合數位科技，提供書法互動體驗，讓民眾臨摹、拓碑，領略篆、隸、草、楷四種書體變化，以及書法文字的結構與章法，互動體驗書法藝術還可現場列印成品留做紀念。

新媒體展示近年逐漸成為潮流趨勢，〈揮翰學書〉書法跨域新媒體展以科技轉譯故宮經典文物，拉近觀眾與傳統書法作品的距離。展區分為「惟妙惟肖—臨摹體驗」、「黑老虎的誕生—拓碑體驗」及「千文字宙—沉浸互動劇場」、「筆畫拼拼看」四個主題，透過虛擬互動數位技術，讓觀眾能以多樣化方式參與和體驗書法藝術。



圖 4-3-7 「千文字宙沉浸式劇場」，讓觀眾從遊戲中學習各種書體

圖片來源:

<https://www.ydn.com.tw/news/newsInsidePage?chapterID=1634367&type=life>

(一)個案簡介:〈揮翰學書—書法跨域新媒體展〉

書法是奠基於對書寫技巧與風格的掌握，「臨」、「摹」是學習書法的重要途徑，寫字要從「臨」、「摹」開始，其目的是學習書寫與了解書法的美學技巧，從而建立書寫美感的能力。碑帖是古來經典傳承的載體，也是書法智慧和經驗的具體化，真實體現當中所有的技巧。展區以數位 e 筆模擬書法的真實筆觸，讓觀眾仿寫王羲之、懷素、蘇軾及黃庭堅等歷代名家的經典字跡與碑帖，體驗「臨」、

「摹」的不同之處，享受學習書法的樂趣。

「黑老虎的誕生」是虛實整合的拓碑體驗，一般是以墨拓法將鑿刻的文字轉印至紙張上，故又稱「黑老虎」。拓本所留下的珍貴史料，常被作為書法臨習的範本。



圖 4-3-4 拓碑教學影片介紹

展覽地點:國立故宮南院

圖片來源:蔡竺芯拍攝

2.展覽特點:

- (1) 數位互動性：觀眾可使用數位筆模擬書法書寫，學習筆劃結構與書法意境。
- (2) 沉浸式體驗：結合投影與 VR 技術，讓觀眾進入書法創作場景，如古代書齋或書法名家筆會。
- (3) 教育性與趣味性：展覽內含書法藝術的歷史介紹和技法講解，結合趣味互動增強參與感。

(二)賽局資訊與基本假設

1.基本假設

- (1) 參賽者:策展方 C、技術團隊 R
- (2) 資訊狀況:完全、對稱、確定
 - 完全:參賽者雙方皆為平台的創作者，在平台中雙方的資訊及影片為公開透明的，故屬於完全資訊。
 - 對稱:因雙方皆了解平台之獲利模式及狀況故雙方資訊對稱。
 - 確定:在雙方進行決策後，決策與報酬將不在進行更動，故雙方為確定。

2. 賽局資訊

(1) 賽局模型運用: 協調賽局

(2) 賽局分類: 靜態賽局、非零和賽局

(三) 賽局推演

1. 案例名稱: 〈揮翰學書—書法跨域新媒體展〉

以傳統書法藝術為核心，透過動態捕捉、數位筆觸書寫並即時生成互動裝置，觀眾可在虛擬展演中欣賞，亦可透過實踐協同創作產生動態的美感。傳統書法美學與新媒體技術整合的研究模式以賽局策略矩陣展示詮釋（高標準）與淺度呈現（低標準）之間的互動結果，策展方 C 與技術團隊 R 策略協調將影響最終作品的詮釋深度與互動品質。

2. 策略設定：協調賽局

(1) 策展方 C：深度詮釋(H)/淺度詮釋(L)

(2) 技術團隊 R：高階技術(H)/基礎技術(L)

3. 賽局方格：策展方 C 對技術團隊 R

表 4-3-1 賽局方格: 策展方 C 對技術團隊 R

策展方 C	技術團隊 R		
		高階技術(H)	基礎技術(L)
	深詮釋(H)	$(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$	$(\Theta + \lambda + \phi, \bar{U} - \phi)$
	淺詮釋(L)	$(\Theta - u, \bar{U} + \bar{O} + u)$	$(\Theta, \bar{U})$

(四) 函數說明：

1. (H,H)：策展方 C 採深度詮釋(H)搭配技術團隊 R 高階技術(H)產生 $(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$ 高收益，作品美學與互動體驗並存。
2. (L,L)：若雙方都採用淺度詮釋(L)與基礎技術(L)，效果雖不如(H,H)效益，但因策略一致仍有穩定收益 $(\Theta, \bar{U})$ ，形成另一個協調均衡。
3. (H,L)或(L,H)不匹配時，呈現品質落差與整體價值下降，說明不一致的策略組合降低成效。

案例以高品質均衡(H,H)為目標，研究模式可分析資訊傳遞機制（如事前溝通、技術標準訂立），如何引導雙方從(L,L)或不匹配狀態趨近(H,H)。

表 4-3-2 策展方 C 對技術團隊 R 之協調賽局

策展方 C	技術團隊 R		
		高技術(H)	低技術(L)
	深詮釋(H)	$(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$	$(\Theta + \lambda + \phi, \bar{U} - \phi)$
	淺詮釋(L)	$(\Theta - u, \bar{U} + \bar{O} + u)$	$(\Theta, \bar{U})$

案例以高品質均衡(H,H)為目標，研究模式可分析資訊傳遞機制（如事前溝通）再引導雙方從(L,L)或不匹配狀態趨向(H,H)。如下說明：

1. (H,H)：策展方 C 與技術團隊 R 雙方都採高度詮釋(H)和高階技術(H)觀眾體驗大幅提升，產生最大效益 $(\Theta + \lambda + \phi - u, \bar{U} + \bar{O} + u - \phi)$ ，此為理想狀態的協調均衡。
2. (L,L)：若雙方都採用淺度詮釋(L)與低階技術(L)，效果雖不如(H,H)，但策略一致尚有穩定收益 $(\Theta, \bar{U})$ 而形成另一個協調均衡。
3. (H,L)或(L,H)不匹配時整體價值下滑，顯示不一致的策略組合降低成果。

(五)管理意涵

當賽局有兩個或更多的納許均衡時，每一個均衡都可能發生，雙方的行動也會影響到對方，透過各種協調或選擇來達到自己預期的目標。以上三個案例透過賽局推導，了解虛擬藝術展演中的多方行為者的策略選擇如何影響整體價值。各案例均呈現「高品質匹配」與「低標準匹配」為不同層次的協調均衡，而高標準匹配(H,H)通常帶來更高的藝術價值與整體利益。透過資訊流通、誘因設計、預先溝通、試演與口碑傳播等機制，可引導行為者走向高標準的均衡狀態。

伍、 結論

賽局理論應用於虛擬藝術展演之研究以〈會動的清明上河圖〉、〈達文西體驗展～超越 500 年的輝煌〉以及〈揮翰學書—書法跨域新媒體展〉三案例為分析對象，藉由協調賽局（Coordination Game）模型推導後歸納以下研究結論：

一、多方行為者協作與「高品質策略」的必要性

1.行為者多元、利益取向多樣

案例各自呈現策展單位、藝術家、技術團隊、贊助者／收藏者、評論者與觀

眾等多方利害關係人共同參與的生態。在傳統展演中，往往由策展單位與藝術家居主導地位；然而在虛擬展演領域，技術平台與觀眾的互動需求扮演了更關鍵角色，使決策過程需協同的層面更深。

2. 協調賽局中的高品質帶來最大綜效

依據協調賽局模型，若策展方、技術團隊以及其他主要利害關係人能透過事前溝通、資訊傳遞與誘因設計，同時選擇「高品質策略」（如採用高階沉浸式技術、深度詮釋、完善的使用者體驗等），則整體生態可得到最高回報，包括觀眾滿意度提升、藝術價值突顯與經濟收益增長，反之則在中低收益的均衡狀態。

二、虛擬展演價值形成的動態機制

1. 藝術家與策展方：詮釋深度與技術融合

- (1) 〈會動的清明上河圖〉：將傳統繪畫透過數位動畫與互動場景重構，若藝術家與策展人能協調出高階數位視覺標準（如精緻動畫製作），將吸引更多廣大觀眾投入與社群分享。
- (2) 〈達文西體驗展～超越 500 年的輝煌〉：強調跨領域知識與沉浸式技術的結合。策展方與技術供應商若採取一致的高規格投入（如精準還原達文西機械發明、VR／AR 互動），讓觀眾願意深度參與，口碑與迴響度將倍增。
- (3) 〈揮翰學書—書法跨域新媒體展〉：需平衡傳統書法美學的精神與數位媒材的創新表現，若策畫與技術標準達到高階匹配（例如互動筆觸捕捉、多媒體裝置設計），即可將觀眾體驗推向更深層次。

2. 觀眾與評論者：互動參與與評價機制

若在前期行銷或展演設計中，透過誘因機制吸引觀眾「深度參與」而非「淺度瀏覽」，同時讓評論者深入體驗並給予正向評價，能強化口碑效應與社群影響力。

3. 技術團隊與贊助者／收藏者：成本效益與資源配置

在高階技術匹配狀態下，技術團隊雖需投入較多研發與設備成本，但若展演成功，則可強化品牌形象並獲得長期合作機會；贊助者或收藏者亦將因高知名度與藝術價值增長而收益。協調賽局分析顯示，只要各方能意識到高品質策略的長遠利益優於短期壓低成本，便容易在溝通與協調過程中達成一致。

三、應對後疫情時代的實務意涵

1. 虛實整合持續深化

後疫情時代觀眾養成了線上參與習慣，多方利害關係人若採用高標準的虛擬策畫模式（如多平台同步直播、互動商城、虛實整合票務等），有助於擴大受眾範圍並實現跨地域展演。協調賽局凸顯主要參與者都支持「虛實整合」並落實高品質策略，展演生態將進入正向循環。

2. 資訊傳遞與誘因設計的重要性

賽局結果顯示，前期籌備與雙邊或多邊資訊對稱，是形成「高品質匹配均衡」的關鍵。無論是策展單位與技術供應商或是贊助者與收藏者，若能透過商業模式、合約規範、資金補助、聲譽回饋等方式降低不確定性，則多方更願意採取高標準策略，觀眾亦能從預熱宣傳或試營運機制中感受到展演品質，增加後續口碑傳播之可能。

綜合三個案例的協調賽局分析，若策展方、藝術家、技術團隊與其他利害關係人能集體選擇高標準策略（高沉浸度、高互動性、高美學詮釋等），則整體展演價值顯著提升有助於建立長期競爭優勢。觀眾滿意度與參與度提升後，會形成再度消費與社群口碑的「正向循環」，吸引更多資源投入與後續合作機會，所以高水平協調均衡帶來長期競爭優勢。若行為者協調失敗，便容易陷入以降低成本、節省資源為主的「次佳均衡」，導致整體呈現品質及市場聲量無法最大化。在虛擬藝術展演逐漸走向專業化與國際化，能否透過策略溝通、資訊分享與誘因設計，達成高品質協作成為展演成敗的關鍵。

透過案例的賽局模型推導，說明賽局理論在虛擬展演領域的可行性與實用性，只要誘因機制與資訊傳遞完善，多方參與者能夠「協同升級」而不是「各自為政」。研究結果對後疫情時代的數位藝術策展與博弈分析皆具有參考與應用價值，也為未來相關跨領域研究提供相關理論基礎與實務啟示。

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The Impact of Liquidity on Stock Returns of Vietnamese Commercial Banks

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Abstracts

This paper investigates the impact of liquidity on the stock returns of Vietnamese commercial banks listed on the Ho Chi Minh Stock Exchange (HOSE) during 2019 – 2023. We use panel data from 15 listed banks and apply Ordinary least squares (OLS), Fixed effects model (FEM) and Random effects model (REM) to examine how liquidity indicators influence stock performance. The study employs Bid-ask spread and Turnover ratio as key liquidity proxies, and includes control variables such as Price to Earnings ratio (P/E), Book to market ratio (B/M), Market return (R_m) and Market capitalization (SIZE). Results show that the Bid ask spread significantly negative effect under certain models. The findings suggest that liquidity plays a keys role in determining stock performance and has implication for investors and policymakers.

Keywords: Liquidity, Stock Returns, Bid-Ask Spread, Vietnamese Banks, Panel Data, Market Efficiency

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1. Introduction

In the Vietnamese stock market, banking stocks are one of the types of stocks that attract the majority of investors. Banking stocks are always considered the "king stocks" on the stock market. According to statistics¹⁰, the current group of industry stocks, especially the group with Vietnamese banking stocks, is receiving great attention from domestic and foreign investors. Banking is one of the industries that is strictly regulated by Vietnamese law, and the level of improvement of banks is increasingly stronger than that of enterprises in other industries and fields. Risk management issues are operated according to international practices. In addition, the group of banking stocks with large capitalization, always in the top 5 groups with the best profits in the Vietnamese market today, plays the leading role in the Vietnamese market. The banking stock group is also a group of stocks with many investment opportunities due to the high number of listed banks, so factors affecting the stock returns are also of interest.

Liquidity is considered one of the important factors that reflect the development of the stock market. Liquidity is the ability of any asset to be bought or sold on the market at a price close to the standard value estimated based on the combined assessments of analysts on that asset (Foucault et al., 2013). The liquidity of the stock market indicates the ease of buying and selling assets in the market. This ease is crucial for investors, as it allows them to enter and exit positions without significant price fluctuations. High liquidity typically attracts more participants to the market, fostering a more efficient trading environment and contributing to overall market stability. Market stability, in turn, can lead to increased investor confidence, encouraging further investment and participation. As a result, understanding the dynamics of liquidity becomes essential for both individual and institutional investors seeking to optimize their trading strategies. Trading strategies that account for liquidity can help investors minimize costs and maximize returns. Consequently, a thorough analysis of liquidity trends can provide valuable insights into potential market movements and investment opportunities. Investment opportunities can arise from identifying patterns in liquidity fluctuations, allowing traders to position themselves advantageously. By leveraging this understanding, investors can navigate market conditions more effectively and enhance

¹⁰ Source: According to a recent banking industry report by SSI Research 2024

their overall portfolio performance. The higher the liquidity, the more dynamic the market becomes. There are many different views of the impact of liquidity on stock returns. Researching the Vietnamese stock market, Nguyen A. (2019) suggests that increased liquidity not only reduces trading costs but also contributes to price stability, ultimately attracting more investors. This dynamic can lead to higher stock returns, particularly in emerging markets where liquidity may still be developing. P. (2019) pointed out that liquidity does not affect the returns and risks of listed stocks. However, also studying the Vietnamese market, Batten and Vo (2014) found a positive relationship between liquidity and stock returns. This result did not change when additional control factors were added according to the Fama - French three-factor model. Liquidity is recognized as a dynamic attribute that significantly impacts stock returns, as highlighted by studies such as Chordia, Roll, and Subrahmanyam (2001, 2008), Pástor and Stambaugh (2003), and Avramov and Chordia ((2006). Since investors are concerned with the expected returns over the holding period after accounting for trading costs, assets that are less liquid and more expensive to trade must offer higher gross returns than more liquid assets to compensate for these costs. This expectation is even more pronounced in emerging and developing markets, where institutional barriers, inefficiencies related to private information, and the impact of capital restrictions are more prevalent. (e.g., Bekaert and Harvey, 1997; Easley, HHHvidkjær, and O'Hara 2010; Hearn 2011)¹¹.

From a macro perspective, some studies have shown that market liquidity affects the overall market return due to changes in investors' expectations of stock returns. Specifically, Kyle (1985), de Long et al. (1990) observed noise trading in the market, thereby indicating that liquidity is a manifestation of market sentiment. According to the authors, increased liquidity is a sign of good market sentiment; at the same time, due to good sentiment, investors expect stocks to have high returns. Agreeing with the above view, empirical studies also show that stock market liquidity increases during periods of rising market sentiment (Liu, 2015), leading to an impact on stock returns due to increased investor and market expectations. In addition, liquidity can also increase due to the increase of irrational investors in the market (Baker and Stein, 2004). Studies on the impact of liquidity on market returns have mainly focused on developed

¹¹ In addition, here is a significant literature that investigates stock market return behavior and anomalies in emerging markets.

markets, where there is more stability and transparency in financial factors. Most of the existing studies have separately studied the impact of liquidity on returns or stock prices, but there is a lack of comprehensive studies analyzing the impact of liquidity on stock returns in the stock market in general. In particular, in the Vietnamese stock market, there have not been many in-depth and systematic studies on the overall impact of liquidity on stock returns, although this is a very important factor affecting investment decisions and fluctuations in asset values in this market. Therefore, research on the impact of liquidity on returns in the context of Vietnam is still an area with many shortcomings and needs further research.

The topic the impacts of liquidity on stock returns of Viet Nam commercial bank listed on the Viet Nam stock exchange hope that can provide investors with empirical evidence to have an optimal perspective on liquidity of stock returns when investing in commercial bank stocks in the coming time.

2. Literature

Liquidity is a critical concept in financial markets, referring to the ability of an asset to be converted into cash quickly and at minimal cost. In the context of stocks, liquidity reflects how easily a security can be bought or sold without causing significant changes in its price. Liquid markets are characterized by high trading volumes, narrow bid-ask spreads, and minimal price volatility. Theoretical foundations from Amihud and Mendelson (1986), Pastor and Stambaugh (2003), and Acharya and Pedersen (2005) emphasize that liquidity—or the lack thereof—is an important risk factor that investors consider when determining expected returns. When assets are illiquid, investors require compensation in the form of higher expected returns to bear the additional risk and transaction costs associated with trading.

Stock returns, meanwhile, represent the gains or losses made by investors over a period and are typically calculated as the percentage change in stock prices. According to Fama (1970), stock returns are the reward investors earn for bearing the risk associated with holding equity securities, influenced by both firm-specific fundamentals and broader market conditions. While traditional asset pricing models such as the Capital Asset Pricing Model (CAPM) often ignore liquidity, more recent extensions of these models have integrated liquidity risk as a significant explanatory variable for returns.

Extensive empirical studies, particularly in developed markets, have documented a strong link between stock liquidity and returns. For instance, Amihud (2002) introduced the illiquidity ratio (ILLIQ), which measures the average daily price response associated with trading volume. He found that stocks with lower liquidity (higher ILLIQ values) tend to offer higher expected returns. Similarly, Brennan and Subrahmanyam (1996) found that illiquid stocks, often identified by wider bid-ask spreads and lower trading activity, yield higher returns due to compensation for higher transaction costs and difficulty in execution.

Chordia et al. (2005) further examined this relationship using NYSE data and concluded that increased liquidity—proxied by higher trading volume and turnover—correlates with lower expected returns, supporting the theory that investors accept lower returns when trading is easier and cheaper. Datar, Naik, and Radcliffe (1998) found that stocks with lower turnover ratios tend to generate higher returns, reinforcing the idea that illiquid assets carry a risk premium. Their research highlighted that a 1% decrease in turnover could lead to a 4.5% increase in expected stock returns.

On the behavioral side, Hong and Stein (2007) argued that sudden spikes in liquidity may be the result of irrational investor behavior, particularly herding and overreaction to market news, which can distort price signals and affect return patterns. Their work, grounded in behavioral finance, added a psychological dimension to the understanding of liquidity-return dynamics, especially in markets dominated by retail investors.

In terms of firm-specific characteristics, studies by Fama and French (1992, 1993) suggest that small-cap stocks and those with high book-to-market ratios (value stocks) tend to outperform their large-cap and growth counterparts. These findings are often integrated into three-factor or five-factor asset pricing models, where liquidity acts as either an additional factor or an underlying mechanism influencing other established factors.

While liquidity-return relationships have been widely studied in developed markets, research in emerging markets - such as Vietnam - remains relatively sparse and less conclusive. Emerging markets often face structural inefficiencies, limited transparency, and higher volatility, all of which can magnify the impact of liquidity on asset prices.

Nguyen (2019) suggested that increased liquidity in Vietnam reduces transaction costs and stabilizes prices, thereby attracting investors and potentially enhancing returns. In contrast, other local studies have found weak or no statistically significant impact of liquidity on stock returns. Batten and Vo (2014), using a dataset of Vietnamese equities, confirmed a positive relationship between liquidity and returns even after incorporating control variables from the Fama - French three-factor model. However, inconsistencies remain, partly due to the volatility and informational asymmetry inherent in Vietnam's stock market.

Given these contrasting results, there is a clear need for more comprehensive research into how liquidity influences stock returns, particularly within specific sectors such as banking, which plays a central role in Vietnam's financial system. Listed commercial banks in Vietnam are subject to stricter disclosure regulations and are typically more liquid than other sectors, making them an ideal subject for examining the effects of liquidity on stock returns.

Based on this literature, the current study hypothesizes that liquidity negatively affects stock returns and focuses on key variables such as bid-ask spread, trading volume, and turnover ratio, with control factors including firm size, P/E ratio, book-to-market ratio, and market return. These insights provide the theoretical grounding for developing the research model and conducting empirical analysis on Vietnam's stock market.

3. Research methodology

This research relies on secondary data obtained from the audited financial statements of 15 commercial banks listed on the Ho Chi Minh City Stock Exchange (HOSE), covering the period from the first quarter of 2019 to the fourth quarter of 2023, leading to a total of 300 observations. The dataset is compiled on a quarterly basis for each fiscal year within the study period. Financial statements were sourced from reputable and reliable online platforms specializing in financial, economic, and securities information in Vietnam. The data includes stock prices, trading volumes, and a range of financial indicators related to the listed commercial banks on HOSE. Table 1 shows the number of commercial banks selected for the study. Table 1 shows the number of commercial banks selected for the study along with the study period and number of observations.

Table 1: List of banks along with study period and number of observations

S.N.	Bank's name	Study period	Observation
1	Asia Commercial Bank	Q1/2019-Q4/2023	20
2	Bank for Investment and Development of Vietnam	Q1/2019-Q4/2023	20
3	VietinBank	Q1/2019-Q4/2023	20
4	Eximbank	Q1/2019-Q4/2023	20
5	Everland Financial	Q1/2019-Q4/2023	20
6	HDBank	Q1/2019-Q4/2023	20
7	Lien Viet Post Bank	Q1/2019-Q4/2023	20
8	Military Commercial Joint Stock Bank	Q1/2019-Q4/2023	20
9	Shinhan Bank Vietnam	Q1/2019-Q4/2023	20
10	Sacombank	Q1/2019-Q4/2023	20
11	Techcombank	Q1/2019-Q4/2023	20
12	Tien Phong Bank	Q1/2019-Q4/2023	20
13	Vietcombank	Q1/2019-Q4/2023	20
14	Vietnam International Bank	Q1/2019-Q4/2023	20
15	Vpbank	Q1/2019-Q4/2023	20
	Total	-	300

Table 2: Details of variables

Determinants	Variables	Measurements	Notations
Dependent	Stock return	$\log \left(\frac{\text{Current stock price}}{\text{Previous period's stock price}} \right)$	R _i
Independent			
	Bid-ask spread	$\frac{\text{Ask price} - \text{Bid price}}{\text{Average of Ask and Bid}}$	B/A
	Trading volume	$\log \left(\frac{\text{Current period's trading volume}}{\text{Previous period's trading volume}} \right)$	VOL
	Turnover ratio	$\frac{\text{Volume trade}}{\text{Shares Outstanding}}$	TO
Control			
	Price to earnings ratio	$\frac{\text{Price per share}}{\text{EPS}}$	P/E
	Return market	$\frac{\text{Index } t - \text{Index}(t - 1)}{\text{Index}(t - 1)}$	R _m
	Book to market	$\frac{\text{Book value of equity}}{\text{Market value of equity}}$	BE/ME
	Market capital	$\log (\text{market capitalization})$	SIZE

Source: Self Elaborations

Building upon the theoretical framework and drawing from the findings of previous empirical studies, as well as the formulated hypotheses, this study proposes a research model comprising three independent variables and four control variables that influence the stock returns of Vietnamese commercial banks. The structure of this model is presented below and illustrated in Figure 1.

$$R_{i,t} = \alpha + \beta_1 VOL_{i,t} + \beta_2 B/A_{i,t} + \beta_3 TO_{i,t} + \beta_4 P/E_{i,t} + \beta_5 Rm_{i,t} + \beta_6 BE/BM_{i,t} + \beta_7 SIZE_{i,t} + \varepsilon$$

4.1 Descriptive statistics

The descriptive statistics of dependent variables (R_i) and independent variables (VOL , B/A , TO) of the study is shown in Table 3. The descriptive statistics used in this study includes mean, standard deviation, minimum and maximum value of variables and N represent the number of the observation.

Table3: Descriptive statistics

Variables	N	Mean	Std. Dv.	Minimum	Maximum
Ri	300	0.0170	0.0844	-0.3352	0.4119
B/A	300	0.1563	0.0661	0.0417	0.4573
VOL	300	9.2153	1.6042	4.1484	12.5761
TO	300	0.2383	0.2595	0.001	0.9859
P/E	300	10.0098	6.5761	2.26	51.98
BE/BM	300	0.2806	0.3124	0.0140	2.5728
R_m	300	10.7342	36.8023	-83.7	85.9633
SIZE	300	28.3436	1.2922	23.2721	31.2072

Table 3 present the descriptive statistics of Vietnamese commercial bank. The study period is 2019 to 2023 associated with 15 commercial banks listed on the HOSE market exchange. The average stock return (R_i) is 1.7%, while the main liquidity variable (B/A – bid-ask spread) has a mean of 0.1563. The trading volume (VOL) and stock turnover (TO) variables have a mean of 9.2153 and 0.2383, respectively. The P/E and BE/BM ratios vary significantly, indicating large differences in valuation among banks. The market return variable (R_m) has a high standard deviation (36.8), reflecting

large volatility in the market. Finally, the size variable (SIZE) has a mean of 28.34 (natural logarithm), reflecting the size differences among commercial banks.

4.2 Correlation analysis

The correlation between stock return and liquidity of Vietnamese commercial banks is presented in Table 4.

Table 4: Correlation coefficient between variables

	Ri	B/A	VOL	TO	P/E	BE/BM	Rm	SIZE
Ri	1							
B/A	-0.172***	1						
VOL	0.018**	-0.134***	1					
TO	-0.094***	-0.007	0.519***	1				
P/E	0.134***	0.051**	-0.031	0.365***	1			
BE-BM	-0.161***	0.242***	-0.558***	-0.034**	-0.016**	1		
Rm	0.515***	0.106***	0.066***	-0.047**	0.121***	-0.101***	1	
SIZE	0.181***	-0.161***	0.423***	-0.304***	0.016**	-0.659***	0.162***	1

*Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Table 4 presents the correlation coefficients between the main variables in the research model. Stock yield (Ri) is negatively correlated with bid-ask spread (B/A) at the 1% significance level ($r = -0.172$), implying that when market liquidity increases (spread decreases), stock yield tends to increase. The variable Ri is also negatively correlated with TO and BE/BM, but significantly positively correlated with Rm ($r = 0.515$) and SIZE ($r = 0.181$), indicating that stocks of large-sized banks and in the growth market period tend to have higher yields. In addition, the variable B/A is positively correlated with BE/BM and P/E, but negatively correlated with SIZE ($r = -0.161$), indicating that larger banks tend to have better liquidity. Trading volume (VOL) and stock turnover (TO) have a strong positive correlation ($r = 0.519$), reflecting the close relationship between the two liquidity measures. TO and VOL have a fairly high correlation coefficient of 0.519 and are statistically significant at the 1% level. This shows that these two variables are closely related to each other and are capable of providing similar information in the regression model. Therefore, to avoid multicollinearity, which reduces the accuracy of the estimates and causes noise in the

model, the VOL variable is removed, and TO is retained because it is a standardized liquidity measure, more suitable for comparative analysis among banks.

4.3 Hausman Test and Regression Results

The OLS regression results indicate that the liquidity proxy, the Bid-Ask Spread, has a negative and statistically significant effect on the stock returns of listed commercial banks in Vietnam. Specifically, the coefficient for the B/A spread is -0.2803 with a p-value below 0.01, confirming that this negative relationship is significant at the 1% level. Other control variables such as the P/E ratio, book-to-market ratio, and market capitalization do not show statistically significant relationships with returns. The market return variable is positive and highly significant ($p < 0.01$), reflecting the co-movement between bank stock returns and overall market returns, consistent with the Capital Asset Pricing Model (CAPM). The model's coefficient of determination (R-squared) is 33.84%, indicating a reasonably good explanatory power within the context of commercial banks' financial data.

Table 5: OLS regression result

Ri	Coef.	Std.	t	P-value
B/A	-0.2803***	0.0631	-4.44	0.000
TO	-0.0425**	0.0188	-2.26	0.025
P/E	0.0017**	0.0006	2.47	0.014
BE-BM	-0.0212	0.0184	-1.15	0.253
R_m	-0.0011***	0.0001	10.48	0.000
SIZE	-0.002	0.0047	-0.43	0.664
Number of obs	300			
R - Square	0.3384			

*Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Table 6: FEM & REM result

Ri	FEM			REM		
	Coef.	Std.	p-value	Coef.	Std.	p-value
B/A	-0.2574***	0.0683	0.000	-0.2803***	0.0632	0.000
TO	-0.0539	0.0326	0.100	-0.425**	0.0188	0.024
P/E	0.0026**	0.001	0.014	0.0016**	0.0006	0.013
BE/ME	0.009	0.024	0.708	-0.0211	0.0184	0.252
R_m	0.0011***	0.0001	0.000	0.0011***	0.0001	0.000
SIZE	0.0098	0.0071	0.168	-0.002	0.0047	0.664
R²	0.3539			0.3446		
Adjusted R²	0.3146			0.3385		
Prob (F-statistic)	0.0000			0.0000		

*Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

The regression results from the Fixed Effects Model (FEM) show that the Bid-Ask Spread (B/A) variable continues to have a negative and statistically significant impact on stock returns, with a coefficient of -0.2574 and a p-value less than 0.01. This confirms that even after controlling for unobservable bank-specific characteristics, the bid-ask spread maintains a significant negative relationship with stock returns. Similarly, in the Random Effects Model (REM), the B/A Spread remains consistent with a coefficient of -0.2803, statistically significant at the 1% level ($p = 0.000$). Additionally, the turnover ratio (TO) variable continues to exhibit a negative and statistically significant relationship in the REM model, with a coefficient of -0.0426 and a p-value below 0.05. Meanwhile, the P/E ratio, book-to-market ratio, and market capitalization remain statistically insignificant in both models. The market return variable retains a positive and highly significant effect across both FEM and REM, indicating a stable influence of overall market movements on bank stock returns. To determine the more appropriate model between FEM and REM, the Hausman test was conducted (see Table 9), yielding a p-value of 0.8691. Since this p-value exceeds the 0.05 threshold, we fail to reject the null hypothesis (H1), suggesting that the REM model is the preferred specification.

From the three regression methods (OLS, FEM, REM), it can be seen that the liquidity variable B/A Spread gives stable results, has a negative sign and is

highly statistically significant in all models.

Table 7: OLS, FEM, REM regression results

	OLS	FEM	REM
B/A	-0.2803*** (0.0631)	-0.2574*** (0.0683)	-0.2803*** (0.0632)
TO	-0.0425** (0.0188)	-0.0539 (0.0326)	-0.425** (0.0188)
P/E	0.0017** 0.0006	0.0026** (0.001)	0.0016** (0.0006)
BE/ME	-0.0212 (0.0184)	0.009 (0.024)	-0.0211 (0.0184)
Rm	-0.0011*** (0.0001)	0.0011*** (0.0001)	0.0011*** (0.0001)
SIZE	-0.002 (0.0047)	0.0098 (0.0071)	-0.002 (0.0047)
Adj - R2	0.3384	0.3146	0.3384

*Note: Standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Table 7 presents the regression results from three models: OLS, FEM and REM to test the relationship between liquidity variables and stock returns. The B/A (Bid-Ask Spread) variable has a negative and highly significant coefficient in all three models: -0.2803 (OLS), -0.2574 (FEM) and -0.2803 (REM), all significant at the 1% level. This confirms that low liquidity (high B/A) has a negative impact on stock returns. The TO (Turnover) variable has a negative coefficient in all three models and is statistically significant at the 5% level in OLS (-0.0425**) and REM (-0.0425**), indicating that low turnover is also associated with lower returns. The P/E variable has a positive and statistically significant coefficient of 0.0017** (OLS), 0.0026** (FEM) and 0.0016** (REM), respectively, suggesting that stocks with higher valuations tend to generate higher returns. The BE/ME and SIZE variables are statistically insignificant in all three models, indicating a negligible impact on stock returns. The market return variable (Rm) is negative in OLS (-0.0011***) and positive in FEM and REM (0.0011***), but both are highly statistically significant at the 1% level, reflecting the different role of market risk adjustment depending on the model specifications. In terms of explanation level, the adjusted R² coefficient of OLS and REM models both reached 0.3384, higher than

that of FEM (0.3146), showing that OLS and REM are more suitable in explaining stock return fluctuations in this study.

5. Conclusion

The basic objective of this study is to examine the impact of liquidity on stock returns in the Vietnamese commercial banking sector listed on the HOSE stock exchange from Q1/2019 to Q4/2023. The primary liquidity measures analyzed are the Bid-Ask Spread and Turnover Ratio, alongside control variables including the P/E Ratio, Book-to-Market Ratio, Market Capitalization, and Market Return.

To estimate the relationships, three regression models - Pooled OLS, Fixed Effects Model (FEM), and Random Effects Model (REM) - were employed. Following model selection criteria and the Hausman test, the REM was identified as the most suitable model for interpreting the results.

The findings reveal that the Bid-Ask Spread has a significant negative effect on stock returns, supporting the hypothesis that reduced liquidity (higher bid-ask spreads) corresponds with lower returns. This suggests that liquidity risk is indeed priced in the Vietnamese stock market, particularly within the banking sector. Interestingly, the Turnover Ratio also shows a negative and statistically significant impact on returns, which may indicate market inefficiencies or speculative trading behavior. Additionally, the P/E Ratio and Market Return demonstrate positive and significant relationships with stock returns. In contrast, the Book-to-Market Ratio and Market Capitalization do not exhibit statistically significant effects in the model.

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Defensiveness Analysis of the ESG REIT Sectors during the COVID-19 Pandemic Spread

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Abstract

This study employs the bivariate dynamic conditional correlation GJR GARCH (DCC-GJR-GARCH) model to reexamine whether the REIT sectors and the top 10 constituents by Dow Jones U.S. select ESG REIT index weight can be a defensive asset during the COVID-19 pandemic spread. We find that most REIT sectors also have defensiveness properties. Moreover, the empirical results show that REIT sectors with higher weight in the ESG index have more defensiveness characteristics. Our research provides more crucial managerial investment implications for academic researchers and institutional investors in the REITs market and ESG issues.

Keywords: REITs, Defensive, ESG, DCC-GJR-GARCH, COVID-19

1. Introduction

ESG is a concept proposed by the United Nations Global Compact in 2004, which includes "Environmental", "Social" and "Governance". These three pillars are important indicators for evaluating the sustainable operation of enterprises. Regarding capital allocation, sustainable investment, and ESG trends have become the industry's focus today. In addition, ESG indicators have gradually become one of the indicators that contemporary investors pay attention to. Given this trend, many scholars have also begun to study further the impact of company ESG performance on company value and stock price performance (Lins et al. 2017; Starks et al. 2017; Hartzmark and Sussman 2019; Chen et al. 2020; Aroul et al. 2022; Feng and Wu 2023; Chacon et al. 2024). Concerning the study of the relationship between ESG and Real Estate Investment Trusts (REITs), Aroul et al. (2022) find that REITs that perform well on the ESG scale have higher operational efficiency and REITs with better ESG scores are associated with better operational performance. This means the positive association between ESG scores and operational performance is stronger in REITs with higher operational efficiency. On the contrary, Chacon et al. (2024) document that REITs with higher ESG performance scores were found to have lower firm value, lower operating cash flow, and higher firm risk. Furthermore, Feng and Wu (2023) examine how ESG disclosure is related to REIT debt financing and firm value, they find that REITs with higher levels of ESG disclosure have lower cost of debt, higher credit ratings, and higher unsecured debt to total debt ratio, controlling for key firm characteristics.

Prior research shows that REITs tend to have low risk, inflation hedging, and defensiveness characteristics on the U.S. market (Howe and Shilling 1990; Chan et al. 1990; Glascock and Hughes 1995; Wu et al. 2010; Wu et al. 2012). Stephen and Simon (2005) find that REITs in a mixed asset portfolio of stocks and bonds enhance returns and reduce risk. Akinsomi (2021) pointed out that REITs are historically considered attractive assets to investors particularly as the underlying assets are income-producing properties. REITs also distribute a substantial amount of profits as dividends to shareholders. Based on the above studies, we have not observed direct research analyzing the defensive effect of the COVID-19 pandemic on the REITs market and whether the more REITs pay attention to ESG, the more defensive it will be. We believe REITs' characteristics make them defensive assets that may be sensitive to the extreme conditions prevailing amid the COVID-19 pandemic. The pandemic

provided an excellent opportunity to test the defensive nature of the REIT industry and ESG REITs relationships, as most securities were disproportionately losing value at the time. Therefore, studying the defensive and REITs markets during the COVID-19 pandemic allows us to understand the current literature, making our research important for individual and institutional investors to allocate assets.

This study modifies the CCC-GJR-GARCH model developed by Koutmos and Knif (2002) to introduce the property of dynamic conditional correlation to estimate the varying beta of 12 REIT sectors and the top 10 constituents by Dow Jones U.S. select ESG REIT index weight during the period of COVID-19 in the U.S. Engle (2002) considers that the assumption of constant conditional correlations is too restricting for financial data and thereby introduces the time-varying correlations into the model.

The rest of the paper is structured as follows. A description of the data and the research design is presented in Section 2. The empirical results are provided in Section 3. The concluding remarks are shown in Section 4.

2. Data and Research Design

The daily data used in this study are from constituent REITs stocks of Standard and Poor's 500 index and Dow Jones U.S. select ESG REIT index. The components REIT of Standard and Poor's 500 index are AMT-infastructure, BXP-office, EQIX-data center, EQR-residential, HCN-health care, HST-lodging/resorts, IRM-speciality, O-diversified, PLD-industrial, PSA-self storage, SPG-retail, WY-timber. Furthermore, the Dow Jones U.S. select ESG REIT index is designed to measure the performance of publicly traded real estate securities in the Dow Jones U.S. select REIT index that meet sustainability criteria, and we choose the top 10 constituents by index weight as study sample. The ESG REITs are AVB-residential, DLR-data center, EQIX-data center, EXR-self-storage, O-retail, PLD-industrial, PSA-self storage, SPG-retail, VTR-health Care, WELL-health Care, respectively. The study period is covering from January 21, 2020, to May 11, 2023. We select these periods, as the date of first confirmed cases and ended the public health emergency of the U.S. COVID-19 pandemic announced by United States Centers for Disease Control and Prevention (CDC). The Standard and Poor's 500 index is used as the proxy for the market portfolio to estimate systematic risk. All data have been retrieved from Datastream. Returns are calculated by taking the logarithmic difference between daily closing indices.

The statistical properties of the daily REITs return series are listed in Table 1. Panel A shows the result of REIT sectors and Standard and Poor's 500. With the exceptions of BXP-office REITs and EQR-residential REITs, each of the remaining REITs has positive mean returns, whilst SPG-retail is found to have the highest volatility level. The skewness statistics indicate that all return series are either positively or negatively skewed. The kurtosis statistics suggest a departure from normality, that is, all series are highly leptokurtic. Thus, the Jarque-Bera statistics reject the normality for each return series. The results of the Augmented Dicky-Fuller (ADF) reject the hypothesis of unit root for all return series. Consequently, the return is stationary. The Ljung-Box statistics with up to four lags are applied to the squared returns which induced significant non-linear dependence. The Lagrange multiplier statistics with up to four lags reveal the presence of the ARCH effect. Panel B represents statistical properties of ESG REITs. The Ljung-Box statistics and Lagrange multiplier statistics show the ESG REITs return series exhibits volatility clustering.

Table 1 The statistical properties of the daily REITs return series

	Mean	Standard deviation	Skewness	Kurtosis	JB	ADF	Q ² _i (4)	LM(4)
Panel A: REIT sectors and Standard and Poor's 500								
AMT-infastructure	0.0000	0.0208	0.2284	10.466 ₈	1942** _*	-31.79***	455.29* _{**}	84.02** _*
BXP-office	-0.0009	0.0259	0.1918	12.907 ₅	3412** _*	-29.71***	134.78* _{**}	24.44** _*
EQIX-data center	0.0005	0.0213	0.2219	7.2004	619***	-31.82***	234.94* _{**}	46.37** _*
EQR-residential	-0.0001	0.0218	0.0448	11.952 ₂	2782** _*	-16.90***	251.97* _{**}	45.91** _*
HCN-health Care	0.0003	0.0296	0.0315	19.990 ₈	10020* _{**}	-17.69***	365.70* _{**}	78.10** _*
HST-lodging/resorts	0.0004	0.0305	1.3192	16.786 ₇	6839** _*	-29.60***	21.61** _*	4.65***
IRM-speciality	0.0009	0.0228	-0.1885	9.1133	1302** _*	-29.68***	214.07* _{**}	36.31** _*
O-diversified	0.0000	0.0228	-2.1257	37.359 ₂	41602* _{**}	-15.55***	375.79* _{**}	81.20** _*
PLD-industrial	0.0006	0.0217	-0.4531	11.261 ₆	2397** _*	-8.08***	329.49* _{**}	55.33** _*
PSA-self storage	0.0006	0.018	-0.7272	7.7714	864***	-30.41***	276.83* _{**}	46.56** _*
SPG-retail	0.0002	0.036	0.1145	17.744 ₅	7547** _*	-17.06***	404.72* _{**}	66.84** _*
WY-timber	0.0005	0.0285	-0.0117	21.275 ₉	11593* _{**}	-11.66***	314.77* _{**}	55.46** _*
S&p500	0.0004	0.0156	-0.4476	13.270 ₈	3689** _*	-8.58***	636.90* _{**}	118.05** _{**}
Panel B: ESG REITs								
AVB-residential	0.0000	0.0216	-0.2608	12.850 ₀	3381** _*	-17.47***	699.66* _{**}	128.17* _{**}
DLR-data center	-0.0001	0.0219	0.2802	8.1341	927***	-31.08***	322.43* _{**}	52.18** _*
EQIX-data center	0.0005	0.0213	0.2219	7.2004	619***	-31.82***	234.94* _{**}	46.37** _*
EXR-self-storage	0.0006	0.0208	-0.7190	9.3852	1489** _*	-28.58***	96.41** _*	17.48** _*
O-retail	0.0001	0.0228	-2.1269	37.359 ₀	41653* _{**}	-15.56***	376.22* _{**}	81.32** _*

PLD-industrial	0.0006	0.0217	-0.4531	11.261 6	2397** *	-8.08***	329.49* **	55.33** *
PSA-self storage	0.0006	0.0180	-0.7272	7.7714	864***	-30.41***	276.83* **	46.56** *
SPG-retail	0.0002	0.0360	0.1145	17.744 5	7547** *	-17.06***	404.72* **	66.84** *
VTR-health care	0.0003	0.0328	-0.8035	23.574 7	14800* **	-17.55***	744.12* **	139.08* **
WELL-health care	0.0003	0.0296	0.0297	20.000 8	10044* **	-17.70***	366.30* **	78.24** *

Notes: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. JB refers to the Jarque-Bera statistics, which provide a test for normality; ADF refers to the augmented Dickey-Fuller unit root tests; $Q^2_i(4)$ reports the Ljung-Box statistics which test for autocorrelation in the squared returns with up to four lags; and $LM(4)$ reports the Lagrange multiplier statistics which test for ARCH effect with up to four lags.

The analysis of conditional variance suggests that a GARCH-class model is appropriate. Nevertheless, the ordinary GARCH models of Bollerslev (1986) do not distinguish the differential effects of good and bad news on volatility. The GJR-GARCH improved by Glosten, Jagannathan, and Runkle (1993) is applied to examine the asymmetric responses of volatility to positive and negative innovations. Engle (2002) considers that the assumption of constant conditional correlations is too restricting for financial data and, therefore, that a combination of time-varying correlations would be required. This study accordingly modifies the CCC-GJR-GARCH model developed by Koutmos and Knif (2002) to introduce the property of dynamic conditional correlation. It is specified as follows:

$$r_{i,t} = \mu_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$r_{m,t} = \mu_{m,t} + \varepsilon_{m,t} \quad (2)$$

$$\sigma_{i,t}^2 = \alpha_{i,0} + \alpha_{i,1} \varepsilon_{i,t-1}^2 + \alpha_{i,2} \sigma_{i,t-1}^2 + \delta_i S_{i,t-1} \varepsilon_{i,t-1}^2 \quad (3)$$

$$\sigma_{m,t}^2 = \alpha_{m,0} + \alpha_{m,1} \varepsilon_{m,t-1}^2 + \alpha_{m,2} \sigma_{m,t-1}^2 + \delta_m S_{m,t-1} \varepsilon_{m,t-1}^2 \quad (4)$$

$$\sigma_{im,t} = \rho_{im,t} \sigma_{i,t} \sigma_{m,t} \quad (5)$$

where the subscripts i and m are REITs i and the market portfolio, respectively. $r_{i,t}$ and $r_{m,t}$ refer to the continuously compounded returns at time t . $\mu_{i,t}$ and $\mu_{m,t}$ are conditional means. $\varepsilon_{i,t}$ and $\varepsilon_{m,t}$ denote new shocks at time t . $S_{k,t-1}$ is a dummy

variable with a value of unity if $\varepsilon_{k,t-1} < 0$ and zero otherwise for $k=i, m$.

Equation (3) and Equation (4) describe the way how the conditional variance responds asymmetrically to a rise and a fall in the asset price. Specifically, $\alpha_{k,1}$ is the impact of positive return shocks on the conditional variance, while $\alpha_{k,1} + \delta_k$ is the impact of negative return shocks. Positive δ_k indicates a leverage effect embodied in the conditional variance. Equation (5) describes the process of time-varying covariance. Moreover, $\rho_{im,t}$, the dynamic conditional correlation between REITs and market returns, is calculated by using Equation (6) and Equation (7) developed by Engle (2002).

$$\rho_{im,t} = \frac{q_{im,t}}{\sqrt{q_{ii,t}q_{mm,t}}} \quad (6)$$

$$q_{im,t} = \bar{\rho}_{im} + \gamma(z_{i,t-1}z_{m,t-1} - \bar{\rho}_{im}) + \varphi(q_{im,t-1} - \bar{\rho}_{im}) \quad (7)$$

where $\bar{\rho}_{im}$ is the constant unconditional correlation between REITs and market returns and $z_{i,t-1} = \varepsilon_{i,t-1}/\sigma_{i,t-1}$ and $z_{m,t-1} = \varepsilon_{m,t-1}/\sigma_{m,t-1}$ are the standardized residuals of REITs and market returns, respectively.

Equation (7) shows the dynamic process of the conditional correlation. γ and φ capture the effects of previous shocks and previous conditional correlation on the current conditional correlation. If $\gamma + \varphi < 1$, the correlation between the financial assets will revert to the long-run unconditional level after a shock.

With estimation of the model comprising Equations (1)-(7), the time-varying betas for all REITs sectors are calculated using the following formula:

$$\beta_{i,t} = (\sigma_{i,m,t}/\sigma_{m,t}^2) = (\rho_{im,t}\sigma_{i,t})/\sigma_{m,t} \quad (8)$$

In order to further investigate whether the REITs asset is defensive or not, the following regression is specified:

$$\beta_{i,t} = c_i + \pi_{i1}\beta_{i,t-1} + \pi_{i2}S_{m,t-1} + v_{i,t} \quad (9)$$

Equation (9) shows that positive return shocks have an impact of c_i on the betas, while negative return shocks have an impact of $c_i + \pi_{i2}$ on the betas. The REITs are defensive assets if $\pi_{i2} < 0$, which implies that their betas would become smaller in down market.

3. Empirical Results

The results from the estimation of the DCC-GJR-GARCH model for REIT sectors are reported in Table 2. For simplicity, the conditional mean is assumed to be fixed, i.e., $\mu_{i,t} = \mu_i$ and $\mu_{m,t} = \mu_m$. The conditional means for the HCN-health care REITs, the IRM-specialty REITs, the PLD-industrial REITs, the PSA-self-storage REITs, and the WY-timber REITs were larger than μ_m , indicating these five REIT sectors performed better in the period. The others, nevertheless, performed worse.

The conditional variance equation describes the way how volatility responds asymmetrically to a rise and a fall in the asset price. The estimates of δ_i are statistically significantly positive at the 10% level for all of REITs except for the AMT-infrastructure REITs, EQIX-data centers REITs, PLD-industrial REITs, and WY-timber REITs suggesting that the shocks from bad news caused more volatility than those from good news. Hadsell (2006) indicates that volatility moves halfway back to its mean following a given deviation, which is defined as $\alpha_{i,1} + 0.5\delta_i + \alpha_{i,2}$ in the GJR-GARCH model. If $\alpha_{i,1} + 0.5\delta_i + \alpha_{i,2} < 1$, the mean-reverting conditional volatility and shocks are transitory in nature. The estimates of $\alpha_{i,1} + 0.5\delta_i + \alpha_{i,2}$ range from 0.302 (EQIX-data centers REITs) to 0.996 (HST-lodging/resorts REITs), implying that shocks were transitory.

The effect of mean reversion to the permanent component of the unconditional correlation $\bar{\rho}_{im}$ is represented by γ and φ . γ is found to be statistically significantly positive at the 5% level. φ is also significantly positive except for the EQIX-data centers REITs and the WY-timber REITs. The sum of γ and φ lies between 0.160 (EQIX-data centers REITs) and 0.995 (SPG-retail REITs and PSA-self-storage REITs). The condition of $\gamma + \varphi < 1$ is observed, which implies that dynamic conditional correlation moved around a long-run constant level and displayed a mean-reverting dynamic process. Furthermore, this study carried out diagnostic tests on the appropriateness of the model on the standardized residuals, squared standardized residuals, and the cross-product of the standardized residuals using the Ljung-Box test. The results, which are reported in the final five columns of Table 2, indicate that the majority of the DCC-GJR-GARCH specifications are appropriate for the data set in the COVID-19 pandemic period.

Table 3 illustrates estimates of the asymmetric time-varying beta. Evidence shows that the beta works asymmetrically in up and down markets since the asymmetric parameter is negative and statistically significant except for AMT-infrastructure REITs, BXP-office REITs, HST-lodging/resorts REITs, IRM-specialty REITs, and SPG-retail REITs. The negative sign reveals that the REITs' systematic risk was lower in the down market than in the upmarket. The REITs assets,

Table 2. *Maximum likelihood estimates of the DCC-GJR-GARCH model for REIT sectors*

	AMT- infrastructu re	BXP- office	EQIX- data centers	EQR- residential	HCN- health care	HST- lodging/resorts	IRM- specialty	O- diversified	PLD- industrial	PSA- self- storage	SPG- retail	WY- timber
μ_i	0.0002 (0.0006)	-0.0007 (0.0007)	0.0009 (0.0007)	0.0004 (0.0006)	0.0005 (0.0007)	0.0005 (0.0009)	0.0016** (0.0007)	0.0002 (0.0006)	0.0009 (0.0006)	0.0010* (0.0006)	0.0003 (0.0008)	0.0004 (0.0007)
μ_m	0.0006 (0.0004)	0.0005 (0.0004)	0.0009** (0.0004)	0.0004 (0.0004)	0.0004 (0.0004)	0.0005 (0.0004)	0.0006 (0.0004)	0.0004 (0.0004)	0.0004 (0.0004)	0.0005 (0.0004)	0.0004 (0.0004)	0.0003 (0.0003)
$\alpha_{i,0}$	0.0001*** (0.0000)	0.0000*** (0.0000)	0.0003*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0001*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0001*** (0.0000)
$\alpha_{i,1}$	0.1408*** (0.0001)	0.0785*** (0.0269)	0.1612*** (0.0427)	0.0885*** (0.0230)	0.1462*** (0.0320)	0.0049 (0.0097)	0.1271*** (0.0214)	0.1007*** (0.0301)	0.0871*** (0.0201)	0.0691*** (0.0183)	0.0854*** (0.0235)	0.2357*** (0.0506)
$\alpha_{i,2}$	0.4444*** (0.0376)	0.8150*** (0.0292)	0.0893 (0.0777)	0.8357*** (0.0185)	0.8032*** (0.0286)	0.8891*** (0.0153)	0.7271*** (0.0295)	0.8171*** (0.0239)	0.8833*** (0.0141)	0.8803*** (0.0209)	0.8109*** (0.0264)	0.7359*** (0.0416)
δ_i	0.0383 (0.0550)	0.1584*** (0.0398)	0.1029 (0.0848)	0.1091*** (0.0382)	0.0738** (0.0376)	0.2041*** (0.0213)	0.1294*** (0.0379)	0.1061** (0.0464)	0.0249 (0.0266)	0.0350*** (0.0218)	0.1758*** (0.0323)	-0.0491 (0.0608)
$\alpha_{m,0}$	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0001*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)
$\alpha_{m,1}$	0.1518 (0.0463)	0.0742*** (0.0188)	0.3023*** (0.0625)	0.0784*** (0.0206)	0.0856*** (0.0221)	0.0966*** (0.0217)	0.0937*** (0.0246)	0.0462** (0.0194)	0.0588*** (0.0202)	0.0548*** (0.0193)	0.0764*** (0.0194)	0.1046*** (0.0427)
$\alpha_{m,2}$	0.6820*** (0.0367)	0.8437*** (0.0220)	0.1269*** (0.0309)	0.8414*** (0.0253)	0.8183*** (0.0300)	0.7907*** (0.0273)	0.8226*** (0.0275)	0.8742*** (0.0199)	0.8903*** (0.0139)	0.8656*** (0.0207)	0.8193*** (0.0246)	0.7586*** (0.0355)

δ_m	0.1257*	0.1111***	0.3270**	0.1008***	0.1289***	0.1625***	0.0906***	0.0877***	0.0641***	0.1043***	0.1545***	0.1718***
	(0.0797)	(0.0262)	(0.1364)	(0.0276)	(0.0353)	(0.0384)	(0.0318)	(0.0246)	(0.0233)	(0.0253)	(0.0324)	(0.0574)
γ	0.0496***	0.0541***	0.0705**	0.0323***	0.0559***	0.1434***	0.0938***	0.0222***	0.03200***	0.0480***	0.0592***	0.1482***
	(0.0108)	(0.0122)	(0.0323)	(0.0110)	(0.0194)	(0.0376)	(0.0220)	(0.0092)	(0.0080)	(0.0129)	(0.0113)	(0.0555)
φ	0.9145***	0.9258***	0.0895	0.9423***	0.8872***	0.5998***	0.8032***	0.9536***	0.9549***	0.9322***	0.9357***	0.0168
	(0.0009)	(0.0190)	(0.1798)	(0.0221)	(0.0515)	(0.1244)	(0.0526)	(0.0224)	(0.0113)	(0.0203)	(0.0132)	(0.1256)
LogL	4069	4668	4589	4849	4631	4496	4700	4911	4886	4843	4534	4671
$\alpha_{i,1+0.5\delta_i+\alpha_i}$ 2	0.6044	0.9727	0.302	0.9788	0.9863	0.996	0.9189	0.9709	0.9829	0.9669	0.9842	0.9471
$\gamma+\varphi$	0.9641	0.9799	0.16	0.9746	0.9431	0.7432	0.897	0.9758	0.9869	0.9802	0.9949	0.165
$Q_i(4)$	4.73	7.68	4.02	6.58	1.93	5.54	3.21	5.45	3.73	5.65	3.82	5.41
$Q_m(4)$	1.5	4.73	3.33	4.68	4.63	4.72	4.81	5.09	4.98	4.87	4.64	5.17
$Q^2_i(4)$	0.13	5.5	7.75	6.34	5.63	0.96	1.46	2.08	1.33	6.54	5.58	2.99
$Q^2_m(4)$	0.32	0.56	2.31	4.54	1.17	0.92	3.02	2.2	3.54	0.79	0.42	4.52
$Q_{i,m}(4)$	1.78	1.67	3.39	1.94	1.65	1.8	2.05	5.53	6.91	2.69	1.48	2.31

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. Standard errors are in parentheses. $Q_i(4)$ and $Q_m(4)$ are the Ljung-Box test statistics, detecting autocorrelation in the standardized residuals and standardized squared residuals of the DCC-GARCH model up to the fourth lags for $k=i, m$. $Q_{i,m}(4)$ is the Ljung-Box statistics, detecting the cross-product of standardized residuals for asset i and the market m up to the fourth lags.

Table 3. *OLS estimates of the asymmetric time-varying beta for REIT sectors*

$$\beta_{i,t} = c_i + \pi_{i1}\beta_{i,t-1} + \pi_{i2}S_{m,t-1} + v_{i,t}$$

	AMT- infrastructure	BXP- office	EQIX- data centers	EQR- residential	HCN- health care	HST- lodging/resorts	IRM- specialty	O- diversified	PLD- industrial	PSA- self-storage	SPG- retail	WY- timber
c_i	0.1792*** (0.0206)	0.0754*** (0.0158)	0.8018*** (0.0337)	0.0794*** (0.0136)	0.0861*** (0.0152)	0.1817*** (0.0253)	0.1632** (0.0200)	0.0622** (0.0120)	0.0916** (0.0143)	0.0581*** (0.0093)	0.1000** (0.0193)	0.7655** (0.0449)
π_{i1}	0.7120*** (0.0161)	0.9316*** (0.0127)	0.2279*** (0.0330)	0.9234*** (0.0132)	0.9322*** (0.0123)	0.8669*** (0.0174)	0.8354** (0.0191)	0.9278** (0.0130)	0.9240** (0.0131)	0.9310*** (0.0126)	0.9293** (0.0128)	0.4798** (0.0287)
π_{i2}	0.0299 (0.0245)	0.0043 (0.0086)	-0.0785*** (0.0118)	-0.0119* (0.0064)	-0.0287*** (0.0100)	-0.0061 (0.0121)	-0.0054 (0.0106)	-0.0031** (0.0061)	-0.0220** (0.0047)	-0.0212*** (0.0047)	-0.0123 (0.0118)	-0.1205** (0.0329)
	0.7128	0.8666	0.0995	0.8549	0.8616	0.7515	0.6972	0.8616	0.8584	0.8689	0.8654	0.2609
HL	2.04	9.78	0.47	8.7	9.87	4.85	3.85	9.25	8.77	9.69	9.45	0.94

Notes: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. Standard errors are in parentheses. The half life (HL) of a shock, calculated as

$\ln(0.5)/\ln(\pi_1)$, measures the degree of persistence.

therefore, had lower downside betas, from which the implication for investment strategies is derived. Portfolio would perform better in a down market if more assets with lower downside betas were included in the portfolio.

For instance, the beta coefficient of the diversified REITs was 0.0031 lower in down market than in up market. The mean beta over time for the O-diversified REITs is thus described as $E(\beta_t)=0.0622+0.9278\beta_{t-1}$ in up market and $E(\beta_t)=0.0591+0.9278\beta_{t-1}$ in down market. It is found that the PSA-self-storage REITs ranks first in defensiveness with the lowest value of $c_i + \pi_{i2}$ (0.0369), the HCN-health care REITs ranks next (0.0574), and the EQIX-data centers REITs ranks last with the largest value of $c_i + \pi_{i2}$ (0.7233). It is thus advised that, in order to be defensive in down market, more REITs stocks be included in the portfolio, in particular, those with strong defensiveness like the self-storage REITs and health care REITs. Moreover, the half-life of an innovation varied from 0.47 days for the data centers REITs to 9.87 days for the health care REITs.

For further investigating the volatility of ESG REITs, the estimations of the DCC-GJR-GARCH model are reported in Table 4. The estimates of δ_i are statistically significantly positive at the 10% level for all of REITs except for the EQIX-data centers REITs, PLD-industrial REITs, and WELL-health care REITs suggesting that the shocks from bad news caused more volatility than those from good news. The estimates of $\alpha_{i,1} + 0.5\delta_i + \alpha_{i,2}$ range from 0.302 (EQIX-data centers REITs) to 0.992 (DLR-data center REITs), implying that shocks were transitory. The sum of γ and φ lies between 0.160 (EQIX-data centers REITs) and 0.996 (DLR-data center REITs). The condition of $\gamma + \varphi < 1$ is presented, therefore, that dynamic conditional correlation moved around a long-run constant level and displayed a mean-reverting dynamic process.

Table 5 illustrates estimates of the asymmetric time-varying beta for ESG REITs. Evidence shows all π_{i2} are negative and statistically significant at 10% except for AVB-residential REITs, O-retail REITs, and SPG-retail REITs. The negative sign reveals that the REITs' systematic risk was lower in the down market than in the upmarket. It is worth noting that if REITs is included in ESG, the defensive properties will be clear.

Table 4. *Maximum likelihood estimates of the DCC-GJR-GARCH model for ESG REITs*

	AVB- residential	DLR- data center	EQIX- data center	EXR- self-storage	O- retail	PLD- industrial	PSA- self storage	SPG- retail	VTR- health care	WELL- health care
μ_i	0.0005 (0.0005)	-0.0002 (0.0006)	0.0009 (0.0007)	0.0009 (0.0006)	0.0002 (0.0006)	0.0009 (0.0006)	0.0010* (0.0006)	0.0003 (0.0008)	0.0002 (0.0007)	0.0005 (0.0007)
μ_m	0.0004 (0.0004)	0.0002 (0.0004)	0.0009** (0.0004)	0.0004 (0.0004)	0.0004 (0.0004)	0.0004 (0.0004)	0.0005 (0.0004)	0.0004 (0.0004)	0.0004 (0.0004)	0.0004 (0.0003)
$\alpha_{i,0}$	0.0000*** (0.0000)	0.0000** (0.0000)	0.0003*** (0.0000)	0.0000** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000** (0.0000)	0.0000*** (0.0000)
$\alpha_{i,1}$	0.0786** (0.0379)	0.03150** (0.0128)	0.1612*** (0.0427)	0.0510 (0.0474)	0.1007*** (0.0301)	0.0871*** (0.0201)	0.0691*** (0.0183)	0.0854*** (0.0235)	0.0557* (0.0336)	0.1462*** (0.0455)
$\alpha_{i,2}$	0.8046*** (0.0341)	0.9362*** (0.0106)	0.0893 (0.0777)	0.8625*** (0.0536)	0.8171*** (0.0239)	0.8833*** (0.0141)	0.8803*** (0.0209)	0.8109*** (0.0264)	0.8390*** (0.0453)	0.8032*** (0.0307)
δ_i	0.1561*** (0.0482)	0.0478** (0.0217)	0.1029 (0.0848)	0.0745** (0.0370)	0.1062** (0.0464)	0.0249 (0.0266)	0.0350*** (0.0218)	0.1758*** (0.0323)	0.1644*** (0.0421)	0.0738 (0.0531)
$\alpha_{m,0}$	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0001*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)	0.0000*** (0.0000)
$\alpha_{m,1}$	0.0681** (0.0319)	0.0137 (0.0132)	0.3023*** (0.0625)	0.0573* (0.0307)	0.0462** (0.0194)	0.0588*** (0.0202)	0.0548*** (0.0193)	0.0764*** (0.0194)	0.0663** (0.0316)	0.0856** (0.0337)
$\alpha_{m,2}$	0.8400*** (0.0310)	0.9479*** (0.0082)	0.1269*** (0.0309)	0.8414*** (0.0348)	0.8741*** (0.0199)	0.8903*** (0.0139)	0.8656*** (0.0207)	0.8193*** (0.0246)	0.8176*** (0.0339)	0.8183*** (0.0360)
δ_m	0.1132***	0.1100***	0.3270**	0.1338***	0.0877***	0.0641***	0.1043***	0.1545***	0.1429***	0.1289***

	(0.0419)	(0.0206)	(0.1364)	(0.0446)	(0.0246)	(0.0233)	(0.0253)	(0.0324)	(0.0483)	(0.0482)
γ	0.0294**	0.0238***	0.0705**	0.0402**	0.0222**	0.03200***	0.0480***	0.0592***	0.0054***	0.0559*
	(0.0137)	(0.0053)	(0.0323)	(0.0160)	(0.0092)	(0.0080)	(0.0129)	(0.0113)	(0.0000)	(0.0317)
ϕ	0.9403***	0.9718***	0.0895	0.9335***	0.9536***	0.9549***	0.9322***	0.9357***	0.7914***	0.8871***
	(0.0218)	(0.0061)	(0.1798)	(0.0304)	(0.0224)	(0.0113)	(0.0203)	(0.0132)	(0.0016)	(0.0783)
LogL	4882	4700	4589	4740	4911	4886	4843	4534	4601	4631
$\alpha_{i,1}+0.5\delta_i+\alpha_{i,2}$	0.9613	0.9916	0.302	0.9508	0.9709	0.9829	0.9669	0.9842	0.9769	9863
$\gamma+\phi$	0.9697	0.9956	0.16	0.9737	0.9758	0.9869	0.9802	0.9949	0.7968	0.943
$Q_i(4)$	5.97	2.61	4.02	0.96	5.45	3.73	5.65	3.82	1.42	1.93
$Q_m(4)$	4.76	5.14	3.33	4.77	5.09	4.98	4.87	4.64	4.87	4.63
$Q_i^2(4)$	1.45	4.06	7.75	1.69	2.2	1.33	6.54	5.58	3.04	1.17
$Q_m^2(4)$	2.27	3.05	2.31	1.87	5.53	3.54	0.79	0.42	2.33	1.65
$Q_{i,m}(4)$	6.26	5.08	3.39	6.88	2.08	6.91	2.69	1.48	5.53	5.63

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. Standard errors are in parentheses. $Q_i(4)$ and $Q_m^2(4)$ are the Ljung-Box test statistics, detecting autocorrelation in the standardized residuals and standardized squared residuals of the DCC-GARCH model up to the fourth lags for $k=i, m$. $Q_{i,m}(4)$ is the Ljung-Box statistics, detecting the cross-product of standardized residuals for asset i and the market m up to the fourth lags.

Table 5. *OLS estimates of the asymmetric time-varying beta for ESG REITs*

$$\beta_{i,t} = c_i + \pi_{i1}\beta_{i,t-1} + \pi_{i2}S_{m,t-1} + v_{i,t}$$

	AVB-	DLR-	EQIX-	EXR-	O-	PLD-	PSA-	SPG-	VTR-	WELL-
	residential	data center	data center	self-storage	retail	industrial	self storage	retail	health care	health care
c_i	0.1091***	0.0338***	0.8018***	0.0794***	0.0622***	0.0916***	0.0581***	0.1000***	0.1829***	0.0861***
	0.0156	0.0068	(0.0337)	0.0117	0.0120	(0.0143)	(0.0093)	(0.0193)	0.0218	0.0152
π_{i1}	0.8870***	0.9802***	0.2279***	0.9231***	0.9278***	0.9240***	0.9310***	0.9293***	0.8553***	0.9322***
	0.0160	0.0073	(0.0330)	0.0131	0.0130	(0.0131)	(0.0126)	(0.0128)	0.0176	0.0123
π_{i2}	-0.0086	-0.0341***	-0.0785***	-0.0300***	-0.0031	-0.0220***	-0.0212***	-0.0123	-0.0498***	-0.0287***
	0.0063	0.0042	(0.0118)	0.0055	0.0061	(0.0047)	(0.0047)	(0.0118)	0.0130	0.0100
	0.7882	0.9564	0.0995	0.8584	0.8616	0.8584	0.8689	0.8654	0.7438	0.8755
HL	5.78	34.66	0.47	8.66	9.25	8.77	9.69	9.45	4.43	9.87

Notes: *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. Standard errors are in parentheses. The half life (HL) of a shock, calculated as $\ln(0.5)/\ln(\pi_1)$, measures the degree of persistence.

4. Conclusions

This research uses the daily data covering the period from January 21, 2020, to May 11, 2023, retrieved from Datastream, this research empirically tests whether the 12 REITs sectors and the top 10 constituents by Dow Jones U.S. select ESG REIT index weight are defensive during the full time of coronavirus disease (COVID-19) pandemic in the U.S. The method utilized in this study is the dynamic conditional correlations bivariate GJR GARCH (DCC-GJR-GARCH) model. Firstly, we find that the shocks were transitory and the dynamic conditional correlation moved around a long-run constant level. Moreover, this study shows that the 7 REIT sectors, i.e., EQIX-data centers, O-diversified, HCN-health care, PLD-industrial, EQR-residential, PSA-self-storage, and WY-timber, acted as the defensive stocks in the sample period. As regards the top 10 constituents by Dow Jones U.S. select ESG REITs index weight, the results show that EXR-self-storage, PLD-industrial, PSA-self storage, SPG-retail, and WELL-health Care performed better in the period. Furthermore, it found that the top 10 constituents, i.e., DLR-data center, EQIX-data center, EXR-self-storage, PLD-industrial, PSA-self storage, VTR-health Care, and WELL-health Care can be activated as defensive assets during this study period.

According to the above research, during the COVID-19 pandemic in the U.S., we find that most REIT sectors except for AMT-infrastructure REITs, BXP-office REITs, HST-lodging/resorts REITs, IRM-specialty REITs, and SPG-retail REITs also have defensive properties. Moreover, the empirical results show that REIT sectors with higher weight in the ESG index have more defensiveness characteristics except for retail and residential REIT sectors. Our study provides more crucial managerial investment implications for academic researchers and institutional investors in the REITs market and ESG issues.

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A 52-Week High Turnover-Based Investment Strategy and Its Performance Analysis

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Abstract

This study employs stock turnover as a proxy for market liquidity to examine its relationship with stock returns. A turnover ratio is constructed based on the 52-week high, and portfolios are formed into terciles and deciles according to the level of this ratio. The average monthly returns of these portfolios are analyzed over holding periods of one, three, six, nine, and twelve months. Empirical results indicate a positive relationship between turnover and stock returns.

Although prior literature suggests that turnover may be driven by tax-related factors leading to a January effect, this study finds no significant evidence of such an effect, implying that return performance is not tax-induced. Further analysis shows that the high-turnover portfolios are not influenced by firm size effects.

Moreover, when evaluated using the Capital Asset Pricing Model (CAPM), the Fama-French three-factor model, and the Carhart four-factor model, the portfolio returns are found to be unaffected by market risk premiums, firm size, book-to-market premiums, or momentum factors.

Finally, quantile regression is employed to test for anchoring effects. The results reveal that at higher quantiles, the explanatory power for high-return stocks is stronger, suggesting the presence of investor anchoring bias or nonlinear market sentiment reactions to returns.

Keywords: Turnover, Returns, Liquidity, Investment strategy, 52-week high

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1. Introduction

Within the realm of financial markets, stock market liquidity exerts a pivotal influence on the strategic portfolio allocation decisions undertaken by investors, demonstrably impacting the returns generated by equities (Datar et al., 1998). Among the diverse array of metrics employed to gauge market liquidity, stock turnover emerges as a preeminent and extensively utilized indicator. An elevated turnover rate signifies a heightened frequency of trading activity, indicative of robust liquidity conditions. This suggests that the stock in question is actively traded and enjoys considerable investor preference, primarily attributable to the ease with which it can be resold. Conversely, a diminished turnover rate reflects a state of impaired liquidity and infrequent trading, thereby characterizing the stock as comparatively less appealing or subject to investor neglect. In general, investors exhibit a discernible preference for liquid stocks, which afford greater transactional flexibility and ease of disposition. Conversely, illiquid stocks characterized by low turnover rates are frequently eschewed due to their inherent limitations in tradability.

Stock turnover is quantitatively expressed as the ratio between the number of shares traded and the total number of shares outstanding for a specific company. This metric, also known as a stock's turnover rate or its trading intensity, serves as an indicator of market activity. Research has established a positive correlation between trading volume in the stock market and stock turnover rates (Brown et al., 2009). Existing scholarly literature generally indicates that stocks characterized by high turnover rates are more prone to garner increased investor attention. These highly liquid stocks frequently demonstrate heightened price volatility. Furthermore, empirical findings consistently reveal a positive relationship between stock turnover and stock returns (Lakonishok & Smidt, 1986; Grinblatt & Titman, 1994; Bremer & Kato, 1996; Rouwenhorst, 1999; Glaser & Weber, 2003; Jun et al., 2003; Dey, 2005).

2. Literature Review

2.1. Literature Review on the Positive Relationship Between Turnover and Returns

Lakonishok and Smidt (1986) observed that equities classified as "winner" stocks—those characterized by appreciating prices—generally exhibit elevated turnover rates compared to "loser" stocks, which are defined by declining prices. Their

investigation also suggested that trading activity in January and December is substantially influenced by tax-motivated strategies. Specifically, winner stocks displayed comparatively high turnover in January relative to other months, whereas loser stocks experienced increased turnover in December, aligning with the practice of year-end tax-loss selling. Similarly, Bremer and Kato (1996) presented corroborating evidence, indicating that tax incentives stimulate the realization of capital gains, with winner stocks—defined as those yielding positive returns—demonstrating higher turnover than their loser counterparts.

Grinblatt and Titman (1994) executed an experiment utilizing fund characteristics and identified a positive correlation between turnover rates and excess returns. Rouwenhorst (1999) documented robust cross-sectional correlations between stock returns and turnover rates. Employing data from 20 international markets, the study categorized stocks monthly into high (top 30%), medium (middle 40%), and low (bottom 30%) turnover portfolios. In 12 of these countries, portfolios with high turnover were associated with superior average returns, although these differences did not attain statistical significance.

Wermers (2000) analyzed mutual fund data and reported that funds characterized by higher turnover rates tended to generate higher average returns compared to those with lower turnover. Jun et al. (2003) employed turnover, trading volume, and turnover-to-volatility ratios as liquidity metrics across 27 emerging markets, utilizing both time-series and OLS regression models. Their findings revealed a positive relationship between turnover and monthly returns.

Dey (2005), utilizing OLS regression, determined that portfolios with high turnover outperformed those with low turnover by an average of 7%. Results derived from a two-stage GLS regression also substantiated the premise that markets with higher turnover yielded higher returns.

Collectively, the empirical evidence consistently supports a positive relationship between stock turnover and returns. Brown et al. (2009) further validated this relationship by analyzing monthly trading volume and turnover of the top 1,000 stocks in the S&P 500 and broader market indices. By constructing quintile and decile portfolios based on turnover and employing CAPM and Fama-French factor models, they demonstrated that high-turnover stocks—often large-cap and highly liquid—tend to generate higher returns. They attributed these observations to momentum and

information effects.

In essence, turnover functions as a reliable indicator of market liquidity. Empirical evidence derived from numerous studies demonstrates that portfolios constructed based on high turnover rates tend to produce higher average returns, thereby reinforcing the positive correlation between turnover and stock returns.

An additional avenue of investigation proposes a correlation between stock turnover rates and the efficacy of momentum-based investment strategies. These strategies generally entail the acquisition of stocks demonstrating substantial historical returns, coupled with the divestiture of stocks exhibiting comparatively poor past performance, evaluated across a temporal window spanning three to twelve months. Within the framework of these strategies, stocks characterized by elevated turnover are observed to generate superior profitability, attributable to their propensity to yield augmented returns. In the aforementioned study, daily turnover rates within the stock market were stratified along a spectrum from minimal to maximal, subsequently categorized into three distinct groupings: low, medium, and high turnover cohorts. Within each turnover cohort, stocks were further partitioned into quintiles predicated upon their monthly returns, ranked in ascending order from the nadir to the zenith. The resultant empirical findings indicate a tendency for high-turnover stocks to realize heightened returns, a phenomenon predominantly propelled by high-return "loser" stocks residing within the high-turnover classification (Glaser & Weber, 2003).

2. 2. Literature Review on the Negative Relationship Between Turnover and Returns

Conversely, a subset of scholarly investigations has documented an inverse correlation between stock turnover and subsequent returns (Miller, 1977; Datar et al., 1998; Barinov, 2014). Miller (1977), operating within a framework of heterogeneous investor beliefs, posited that investors with optimistic outlooks tend to exert upward pressure on stock prices, while those with pessimistic views exert downward pressure. Given the constraints on short-selling, pessimistic investors are often precluded from executing sell orders, thereby allowing optimistic investors to disproportionately influence price determination. This dynamic can result in prices diverging from their intrinsic fundamental values, ultimately precipitating speculative price bubbles. Over an extended period, the ensuing price correction mechanism manifests as a turnover effect, wherein elevated turnover is predictive of diminished expected returns.

Datar et al. (1998) conceptualized turnover as a proxy variable for liquidity and employed Generalized Least Squares (GLS) regression analysis to scrutinize its relationship with returns. Their findings revealed a statistically significant negative relationship: a one percent reduction in turnover correlated with a 0.45 percent increase in monthly average returns. Furthermore, their analysis yielded no discernible evidence of a January effect, a seasonal anomaly often observed in financial markets.

Barinov (2014) extended this line of inquiry, demonstrating that turnover exhibits a tenuous relationship with various alternative measures of liquidity risk and, in numerous instances, is negatively correlated with liquidity itself. The study concluded that neither liquidity nor liquidity risk adequately explains the observed phenomenon of high-turnover stocks generating lower expected returns.

In summation, while constituting a minority perspective, these studies collectively suggest that turnover is not invariably positively associated with either liquidity or investment returns. Indeed, elevated turnover may presage lower expected returns, thereby implying an inverse relationship between turnover rates and overall stock performance.

2. 3. Behavioral Biases and the Predictive Power of 52-Week High Turnover Strategies

Empirical investigations have largely corroborated the assertion that stocks characterized by high liquidity generally demonstrate heightened price volatility and maintain a positive correlation with stock returns. In an effort to refine the predictability of future returns, this study pioneers the integration of the 52-week high methodology for the identification of high-turnover stocks. The objective is to employ turnover as an instrumental variable in the detection of stocks exhibiting elevated expected returns. The 52-week high represents a readily available benchmark for both media outlets and investors alike. Stocks trading proximate to their 52-week highs may signify a more robust predictability of returns (George & Hwang, 2004).

The 52-week high frequently serves as a reference point for investors in their evaluation of the potential ramifications of information dissemination. Favorable news developments are capable of propelling prices closer to the 52-week high, whereas adverse news may induce price divergence from this benchmark. The 52-week high momentum strategy posits that such momentum originates from either an underreaction or an overreaction to incoming information. This behavioral bias is intrinsically linked

to a stock's relative position in relation to its 52-week high (George & Hwang, 2004).

Moreover, the profitability of the 52-week high momentum strategy has been observed to correlate with prevailing investor sentiment (Hao, 2018). Research conducted within the U.S. market context furnishes additional evidence of irrational investor behavior, wherein pronounced behavioral biases manifest as stock prices approach their respective 52-week highs (Guo, 2021). Parallel patterns have been identified by Taiwanese scholars, demonstrating that investors in Taiwan exhibit a susceptibility to behavioral biases, notably anchoring effects, when utilizing the 52-week high as a reference point (Hao et al., 2016).

In summation, the 52-week high constitutes a readily accessible and salient datum for investors. Its utilization as a reference point in the assessment of information impact not only bolsters short-term profitability strategies but also augments the predictability of future returns. This proclivity frequently precipitates anchoring behavior, a pivotal behavioral bias that exerts influence over investor decision-making processes.

This research utilizes the 52-week high methodology to pinpoint stocks exhibiting elevated turnover rates. Subsequently, a turnover ratio is formulated to construct investment portfolios designed to forecast prospective stock returns. The turnover ratio is calculated by dividing the highest daily turnover rate of a stock in the current month by its highest daily turnover rate over the past 52 weeks. Employing the magnitude of the turnover ratio as a sorting criterion, stocks are categorized into portfolios spanning a spectrum from high to low turnover ratios. The average monthly returns associated with each portfolio are then subjected to rigorous analysis. These portfolios are maintained over cumulative investment horizons of three, six, nine, and twelve months, enabling the prediction of future cumulative returns.

The subsequent structure of this paper is delineated as follows: Section 2 offers a comprehensive review of the pertinent scholarly literature. Section 3 provides a detailed description of the data utilized and the research methodology employed. Section 4 presents a report on the empirical results obtained through the analysis. Section 5 furnishes additional in-depth analysis and interpretation of the findings. Finally, Section 6 serves to conclude the study, summarizing its key contributions and implications.

3. Data and Methodology

3. 1. Research Data

The temporal scope of this investigation extends from January 1989 to December 2022. The dataset comprises daily stock turnover rates for companies listed on the Taiwan Stock Exchange (TWSE), sourced from the Taiwan Economic Journal (TEJ) database, in conjunction with monthly stock returns spanning January 1990 to December 2022. The sample selection criteria excluded financial institutions, financial holding companies, foreign entities listed on the TWSE, Taiwan Depositary Receipts (TDRs), and corporations with secondary listings in Taiwan that maintain primary listings on foreign exchanges.

3. 2. Research Methodology

The daily turnover rate of each stock for each month is calculated using the following formula:

$$T_{i,d} = \frac{V_{i,d}}{S_i} (1)$$

Where $T_{i,d}$ represents the daily turnover rate of stock i on day d , $V_{i,d}$ represents the trading volume of stock i on day d , and S_i represents the outstanding shares of stock i . The maximum daily turnover rate for each stock in a given month is selected using the following formula :

$$T_{i,m}^{max} = \max(T_{i,d}) \forall k \in month m \quad (2)$$

Where $T_{i,m}^{max}$ represents the maximum daily turnover rate of stock i in month m . The maximum daily turnover rate of each stock in the current month is selected and compared with the maximum daily turnover rates of each month over the past year, including the current month. The formula is as follows :

$$T_{i,m}^{12mo-max} = \max(T_{i,k}^{max}) \forall k \in \{m-11, m-10, \dots, m\} \quad (3)$$

Where $T_{i,m}^{12mo-max}$ represents the maximum value among the monthly maximum daily turnover rates of stock i over the past 12 months from month m . The monthly maximum daily turnover rate/ the monthly maximum daily turnover rate

includes the highest value from the previous 12 months. The formula is as follows :

$$R_{i,m} = \frac{T_{i,m}^{max}}{T_{i,m}^{12mo-max}} \quad (4)$$

The ratio is denoted as $R_{i,m}$. Based on the turnover ratio, the sample is divided into tercile and decile groups. For the tercile grouping, firms are sorted by the turnover ratio and classified into three portfolios : the top 30%(high turnover ratio), the middle 40%(medium turnover ratio), and the bottom 30%(low turnover ratio). The formula is as follows :

$$R_{\pi(1)} \geq R_{\pi(2)} \geq R_{\pi(3)} \geq \dots \geq R_{\pi(n)} \quad (5)$$

Here, $R_{\pi(j)}$ represents the j^{th} value after sorting. The sequence is arranged in descending order, meaning that the first value is greater than the second, and so on, down to the n^{th} value.

$$Top30\% = R_{\pi(1)}, R_{\pi(2)}, \dots, R_{\pi(0.3n)} \quad (6)$$

$$Middle40\% = R_{\pi([0.3n]+1)}, R_{\pi([0.3n]+2)}, \dots, R_{\pi(0.7n)} \quad (7)$$

$$Bottom30\% = R_{\pi([0.7n]+1)}, R_{\pi([0.7n]+2)}, \dots, R_{\pi(n)} \quad (8)$$

Among them, Top 30% refers to the top 30% of data sorted in descending order based on the ratio. Middle 40% refers to the middle 40% of the sorted data. Bottom 30% refers to the bottom 30% of the sorted data. The average stock returns corresponding to the Top 30%, Middle 40%, and Bottom 30% groups are then calculated.

1. The average stock return of the top 30% :

$$A_{top,m} = \frac{1}{[0.3n]} \sum_{j=1}^{[0.3n]} P_{\pi(j),m} \quad (9)$$

$$m = 1, 2, \dots, 12$$

2. The average stock return of the middle 40% :

$$A_{middle,m} = \frac{1}{[0.7n] - [0.3n]} \sum_{j=[0.3n]+1}^{[0.7n]} P_{\pi(j),m} \quad (10)$$

$$m = 1, 2, \dots, 12$$

3. The average stock return of the bottom 30% :

$$A_{bottom,m} = \frac{1}{n - [0.7n]} \sum_{j=[0.7n]+1}^n P_{\pi(j),m} \quad (11)$$

$$m = 1, 2, \dots, 12$$

The notations are defined as follows :

$A_{top,m}$ represents the average return of the top 30% of stocks in month m ;

$A_{middle,m}$ represents the average return of the middle 40% of stocks in month m ;

$A_{bottom,m}$ represents the average return of the bottom 30% of stocks in month m ;

$P_{\pi(j),m}$ denotes the return of the j^{th} ranked stock in month m . The range of m is from 1 to 12, representing the 12-month returns of each stock. For the decile grouping, the stocks are sorted in descending order based on their turnover ratio and then divided into ten equal groups (each representing 10% of the sample).

$$R_{\pi(1)} \geq R_{\pi(2)} \geq R_{\pi(3)} \geq \dots \geq R_{\pi(n)} \quad (12)$$

Here, $R_{\pi(j)}$ represents the j^{th} value after sorting. The sequence is arranged in descending order, meaning the first value is greater than the second, and so on until the n^{th} value.

$$G_1 = R_{\pi(1)}, R_{\pi(2)}, \dots, R_{\pi(0.1n)} \quad (13)$$

$$G_2 = R_{\pi([0.1n]+1)}, R_{\pi([0.1n]+2)}, \dots, R_{\pi(0.2n)} \quad (14)$$

$$G_3 = R_{\pi([0.2n]+1)}, R_{\pi([0.2n]+2)}, \dots, R_{\pi(0.3n)} \quad (15)$$

$$G_4 = R_{\pi([0.3n]+1)}, R_{\pi([0.3n]+2)}, \dots, R_{\pi(0.4n)} \quad (16)$$

$$G_5 = R_{\pi([0.4n]+1)}, R_{\pi([0.4n]+2)}, \dots, R_{\pi(0.5n)} \quad (17)$$

$$G_6 = R_{\pi([0.5n]+1)}, R_{\pi([0.5n]+2)}, \dots, R_{\pi(0.6n)} \quad (18)$$

$$G_7 = R_{\pi([0.6n]+1)}, R_{\pi([0.6n]+2)}, \dots, R_{\pi(0.7n)} \quad (19)$$

$$G_8 = R_{\pi([0.7n]+1)}, R_{\pi([0.7n]+2)}, \dots, R_{\pi(0.8n)} \quad (20)$$

$$G_9 = R_{\pi([0.8n]+1)}, R_{\pi([0.8n]+2)}, \dots, R_{\pi(0.9n)} \quad (21)$$

$$G_{10} = R_{\pi([0.9n]+1)}, R_{\pi([0.9n]+2)}, \dots, R_{\pi(n)} \quad (22)$$

Here, G_1 represents the top 10% of the ratio values; G_2 represents the 11%-20% group; G_3 represents the 21%-30% group; G_4 represents the 31%-40% group; G_5 represents the 41%-50% group; G_6 represents the 51%-60% group; G_7 represents the 61%-70% group; G_8 represents the 71%-80% group; G_9 represents the 81%-90% group; G_{10} represents the bottom 10% of the ratio values.

The average stock returns corresponding to each of the ten groups are then calculated.

1. The average stock return of the top 10% :

$$R_{G_{1,m}} = \frac{1}{[0.1n]} \sum_{j=1}^{[0.1n]} P_{\pi(j),m} \quad (23)$$

$$m=1, 2, \dots, 12$$

2. The average stock return of the 11-20% :

$$R_{G_{2,m}} = \frac{1}{[0.2n] - [0.1n]} \sum_{j=[0.1n]+1}^{[0.2n]} P_{\pi(j),m} \quad (24)$$

$$m=1, 2, \dots, 12$$

3. The average stock return of the 21-30% :

$$R_{G_{3,m}} = \frac{1}{[0.3n] - [0.2n]} \sum_{j=[0.2n]+1}^{[0.3n]} P_{\pi(j),m} \quad (25)$$

$$m=1, 2, \dots, 12$$

4. The average stock return of the 31-40% :

$$R_{G_{4,m}} = \frac{1}{[0.4n] - [0.3n]} \sum_{j=[0.3n]+1}^{[0.4n]} P_{\pi(j),m} \quad (26)$$

$$m=1, 2, \dots, 12$$

5. The average stock return of the 41-50% :

$$R_{G_{5,m}} = \frac{1}{[0.5n] - [0.4n]} \sum_{j=[0.4n]+1}^{[0.5n]} P_{\pi(j),m} \quad (27)$$

$$m=1, 2, \dots, 12$$

6. The average stock return of the 51-60% :

$$R_{G_{6,m}} = \frac{1}{[0.6n] - [0.5n]} \sum_{j=[0.5n]+1}^{[0.6n]} P_{\pi(j),m} \quad (28)$$

$$m=1, 2, \dots, 12$$

7. The average stock return of the 61-70% :

$$R_{G_{7,m}} = \frac{1}{[0.7n] - [0.6n]} \sum_{j=[0.6n]+1}^{[0.7n]} P_{\pi(j),m} \quad (29)$$

$$m=1, 2, \dots, 12$$

8. The average stock return of the 71-80% :

$$R_{G_{8,m}} = \frac{1}{[0.8n] - [0.7n]} \sum_{j=[0.7n]+1}^{[0.8n]} P_{\pi(j),m} \quad (30)$$

$$m=1, 2, \dots, 12$$

9. The average stock return of the 81-90% :

$$R_{G_{9,m}} = \frac{1}{[0.9n] - [0.8n]} \sum_{j=[0.8n]+1}^{[0.9n]} P_{\pi(j),m} \quad (31)$$

$$m=1, 2, \dots, 12$$

10. The average stock return of the bottom 10% :

$$R_{G_{10,m}} = \frac{1}{n - [0.9n]} \sum_{j=[0.9n]+1}^n P_{\pi(j),m} \quad (32)$$

$$m=1, 2, \dots, 12$$

Here, $R_{G(1,m)}$ represents the average return of the top 10% of stocks in month m ; $R_{G(2,m)}$ represents the average return of stocks in the 11%-20% group in month m ; $R_{G(3,m)}$ represents the average return of stocks in the 21%-30% group in month m ; $R_{G(4,m)}$ represents the average return of stocks in the 31%-40% group in month m ; $R_{G(5,m)}$ represents the average return of stocks in the 41%-50% group in month m ; $R_{G(6,m)}$ represents the average return of stocks in the 51%-60% group in month m ; $R_{G(7,m)}$ represents the average return of stocks in the 61%-70% group in month m ; $R_{G(8,m)}$ represents the average return of stocks in the 71%-80% group in month m ; $R_{G(9,m)}$ represents the average return of stocks in the 81%-90% group in month m ; $R_{G(10,m)}$ represents the average return of the bottom 10% of stocks in month m . $R_{\pi(j),m}$ denotes the return of the j^{th} ranked stock in month m . The range of m is from 1 to 12, indicating the 12-month returns for each stock.

The monthly returns of the portfolios are formed based on the turnover ratio sorted into terciles and deciles (Rouwenhorst, 1999; Glaser & Weber, 2003; Brown et al., 2009). The average monthly returns of these two types of portfolios are then held continuously for one month, three months, nine months, and twelve months (Brown et al., 2009).

4. Empirical Results

Table 1 elucidates the descriptive statistics compiled for this study. The quantity of publicly traded companies experienced a substantial increase from 123 in 1990 to 860 in 2022, culminating in a comprehensive dataset comprising 17,591 firm-month observations.

Analyzing the tercile portfolios constructed based on turnover ratios, the cohort of firms constituting the top 30% exhibited an average turnover rate of 6.3001%, with individual values ranging from a maximum of 17.2033% to a minimum of 2.1100%.

The average turnover ratio for this tercile was calculated at 0.7616, fluctuating between a minimum of 0.3667 and a ceiling of 1.0000. The average monthly return realized by this group was 2.5293%, with observed returns spanning from a maximum of 7.0700% to a minimum of -1.4100%.

Conversely, the bottom 30% group demonstrated an average turnover rate of 0.4724%, with individual firm rates varying from a maximum of 2.7767% to a minimum of 0.0833%. The average turnover ratio for this lower tercile was 0.1340, with values ranging from a maximum of 0.6333 to a minimum of 0.0333. The average monthly return for this group was -1.7485%, with returns fluctuating between a maximum of 6.1700% and a minimum of -6.8700%.

Shifting the focus to decile portfolios, the uppermost 10% of firms demonstrated an average turnover rate of 10.3187%, with individual rates ranging from a maximum of 27.9100% to a minimum of 3.5200%. The average turnover ratio for this decile was 0.9467, with values spanning from 0.6200 to 1.0000. The average monthly return for this top decile was 4.3382%, with returns fluctuating between a maximum of 8.1600% and a minimum of 0.4200%.

In stark contrast, the bottom 10% group exhibited an average turnover rate of 0.1933%, with individual rates ranging from a maximum of 1.3600% to a minimum of 0.0400%. The average turnover ratio for this lowest decile was 0.0740, with values ranging from 0.0200 to 0.3500. The average monthly return for this group was -2.9652%, with returns fluctuating between a maximum of 5.2100% and a minimum of -6.9700%.

Synthesizing the results from both the tercile and decile portfolio analyses, a discernible trend emerges: elevated turnover ratios are correlated with augmented monthly returns, while diminished turnover ratios correspond to reduced returns. Notably, within both the top 30% and top 10% groups, the maximum observed turnover ratio plateaus at 1.0000, without exceeding this threshold. This observation intimates that high turnover stocks are consistently trading at or near their 52-week highs, potentially substantiating the presence of anchoring bias in investor behavior.

Table 1. Descriptive Statistics

	Portfolio	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
three equal parts	High 30% turnover	6.3001	5.6900	17.2033	2.1100	2.8013	396
	High 40% ratio	0.7616	0.7733	1.0000	0.3667	0.1482	396
	High 30% returns	2.5293	2.2600	7.0700	-1.4100	1.4480	396
	Middle 30% turnover	1.7344	1.2913	6.8850	0.3875	1.2606	396
	Middle 40% ratio	0.3490	0.3125	0.9900	0.1225	0.1524	396
	Middle 30% returns	0.1348	0.1000	6.7900	-4.7400	1.3360	396
	Low 30% turnover	0.4724	0.3050	2.7767	0.0833	0.4548	396
	Low 40% ratio	0.1340	0.1067	0.6333	0.0333	0.0831	396
	Low 30% returns	- 1.7485	- 1.5500	6.1700	-6.8700	1.5429	396
Ten equal pars	Top 10% turnover	10.318 7	9.3600	27.9100	3.5200	4.4699	396
	Top 10% ratio	0.9467	0.9900	1.0000	0.6200	0.0791	396
	Top 10% returns	4.3382	4.1950	8.1600	0.4200	1.5205	396
	11-20% turnover	5.0955	4.4650	16.5500	1.6000	2.5531	396
	11-20% ratio	0.7519	0.7600	1.0000	0.2800	0.1888	396
	11-20% returns	2.0187	1.7500	6.9500	-2.4800	1.5686	396
	21-30% turnover	3.4861	2.8600	11.4000	0.9600	2.0037	396
	21-30% ratio	0.5863	0.5600	1.0000	0.2000	0.1954	396
	21-30% returns	1.2128	1.0050	6.9200	-3.2400	1.4288	396
	31-40% turnover	2.5510	1.9500	9.3000	0.6200	1.6657	396
	31-40% ratio	0.4676	0.4350	1.0000	0.1600	0.1800	396
	31-40% returns	0.7040	0.5450	6.8900	-3.7700	1.3625	396
	41-50% turnover	1.9093	1.4300	7.6100	0.4200	1.3819	396
	41-50% ratio	0.3773	0.3400	1.0000	0.1300	0.1613	396
	41-50% returns	0.3071	0.1700	6.8400	-4.4100	1.3258	396
	51-60% turnover	1.4248	1.0250	5.8800	0.2800	1.1199	396
	51-60% ratio	0.3061	0.2700	1.0000	0.1000	0.1448	396
	51-60% returns	- 0.0508	0.0000	6.7800	-5.1900	1.3335	396
	61-70% turnover	1.0524	0.7250	4.8100	0.1900	0.8977	396
	61-70% ratio	0.2451	0.2100	0.9600	0.0700	0.1280	396

61-70% returns	- 0.4169	- 0.3000	6.7300	-5.9900	1.3830	396
71-80% turnover	0.7476	0.4900	4.0000	0.1300	0.6860	396
71-80% ratio	0.1903	0.1500	0.8400	0.0500	0.1093	396
71-80% returns	- 0.8521	- 0.6950	6.6800	-6.7400	1.4786	396
81-90% turnover	0.4763	0.3100	3.0300	0.0800	0.4782	396
81-90% ratio	0.1379	0.1100	0.7100	0.0300	0.0885	396
81-90% returns	- 1.4393	- 1.2300	6.5900	-6.9000	1.5942	396
Bottom 10% turnover	0.1933	0.1200	1.3600	0.0400	0.2111	396
Bottom 10% ratio	0.0740	0.0600	0.3500	0.0200	0.0537	396
Bottom 10% returns	- 2.9652	- 2.6800	5.2100	-6.9700	1.6448	396

Table 2 delineates the average monthly returns of portfolios constructed by stratifying stocks into terciles and deciles, predicated on their respective turnover ratios.

Concerning the tercile portfolios:

The disparity in average turnover rate between the uppermost 30% (registering 6.3001%) and the lowermost 30% (at 0.4724%) amounts to a substantial 5.8277%, a figure that exhibits significant positivity.

The differential in turnover ratio between the apex 30% (recorded at 0.7616) and the nadir 30% (at 0.1340) is quantified as 0.6276, similarly demonstrating significant positivity.

The divergence in average monthly return between the leading 30% (yielding 2.5293%) and the trailing 30% (at -1.7485%) culminates in a 4.2778% difference, a result that is both statistically significant and positive.

Regarding the decile portfolios:

The variance in average turnover rate between the uppermost 10% (noted at 10.3178%) and the lowermost 10% (at 0.1933%) is a considerable 10.1254%, indicating significant positivity.

The distinction in turnover ratio between the zenith 10% (measured at 0.9467) and the bottommost 10% (at 0.0740) is calculated as 0.8727, also reflecting significant

positivity.

The contrast in average monthly return between the top-tier 10% (producing 4.3382%) and the bottom-tier 10% (at -2.9652%) culminates in a 7.3033% difference, a finding that is markedly significant and positive.

These findings collectively suggest that portfolios characterized by elevated turnover and turnover ratios correlate with demonstrably superior returns, while those exhibiting diminished turnover metrics beget significantly inferior returns. Furthermore, the intensification of portfolio granularity (exemplified by decile versus tercile segmentation) amplifies the differentiation in returns, implying that a more refined stratification based on turnover ratios augments the predictability of returns.

Table 2. The average monthly return of investment portfolio three equal parts and ten equal parts.

	Portfolio	Turnover rate	Turnover ratio	Average return
<i>Three equal parts</i>	High 30%	6.3001	0.7616	2.5293
	Middle 40%	1.7344	0.3490	0.1358
	Lower 30%	0.4724	0.1340	-1.7485
	H-L	5.8277	0.6276	4.2778
		(46.4725***)	(119.0223***)	(67.3183***)
<i>Ten equal parts</i>	Top 10%	10.3187	0.9467	4.3382
	11-20%	5.0955	0.7519	2.0187
	21-30%	3.4861	0.5863	1.2128
	31-40%	2.5510	0.4676	0.7040
	41-50%	1.9093	0.3773	0.3071
	51-60%	1.4248	0.3061	-0.0508
	61-70%	1.0524	0.2451	-0.4169
	71-80%	0.7476	0.1903	-0.8521
	81-90%	0.4763	0.1379	-1.4393
	Bottom 10%	0.1933	0.0740	-2.9652
	T-B	10.1254	0.8727	7.3033
		(46.0127***)	(222.7352***)	(82.6303***)

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 3 delineates the average monthly returns of investment portfolios constructed by stratifying firms into terciles and deciles based on their turnover ratios, analyzed across a spectrum of holding periods: one month, three months, six months, nine months, and twelve months.

In the context of the tercile portfolios, the average monthly returns exhibit a notable stability, remaining substantially consistent irrespective of the extension of the holding period from one month to three, six, nine, or twelve months. Analogously, the decile portfolios demonstrate a similar trend, with return patterns displaying consistency across the varying holding periods and exhibiting only marginal deviations when compared to the benchmark one-month holding period.

These findings intimate that the average monthly returns of portfolios formulated on the basis of turnover ratios do not experience an appreciable augmentation when the holding period is prolonged beyond a single month. Across both tercile and decile classifications, extended holding periods—spanning from three to twelve months—do not generate superior average monthly returns relative to the returns achieved through a one-month holding strategy.

Table 3. Analyze the cumulative return rate corresponding to the lowest and highest turnover rate ratio.

	Portfolio	Turnover rate	Turnover ratio	1 month	3 month	6 month	9 month	12 month
<i>Three equal parts</i>	High 30%	6.3001	0.7616	2.5293	2.5138	2.5121	2.5054	2.4945
	Middle 40%	1.7344	0.3490	0.1358	0.1290	0.1285	0.1244	0.1166
	Lower 30%	0.4724	0.1340	-1.7485	-1.7576	-1.7557	-1.7568	-1.7614
	H-L	5.8277	0.6276	4.2778	4.2714	4.2679	4.2622	4.2559
		(46.4725* **)	(119.0223* **)	(67.3183* **)	(81.7676** *)	(87.9686** *)	(91.1292** *)	(93.0736** *)
<i>Ten equal parts</i>	Top 10%	10.3187	0.9467	4.3382	4.3297	4.3287	4.3233	4.3135
	11-20%	5.0955	0.7519	2.0187	2.0076	2.0049	1.9973	1.9851
	21-30%	3.4861	0.5863	1.2128	1.2041	1.2027	1.1957	1.1848
	31-40%	2.5510	0.4676	0.7040	0.6962	0.6946	0.6886	0.6791
	41-50%	1.9093	0.3773	0.3071	0.3000	0.2994	0.2950	0.2867
	51-60%	1.4248	0.3061	-0.0508	-0.0572	-0.0574	-0.0610	-0.0682
	61-70%	1.0524	0.2451	-0.4169	-0.4229	-0.4224	-0.4250	-0.4310
	71-80%	0.7476	0.1903	-0.8521	-0.8579	-0.8570	-0.8582	-0.8633
	81-90%	0.4763	0.1379	-1.4393	-1.4455	-1.4435	-1.4440	-1.4481
	Bottom 10%	0.1933	0.0740	-2.9652	-2.9695	-2.9667	-2.9681	-2.9728
	T-B	10.1254	0.8727	7.3033	7.2993	7.2954	7.2915	7.2863
		(46.0127* **)	(222.7352* **)	(82.6303* **)	(101.5017* **)	(109.5492* **)	(113.5122* **)	(116.2413* **)

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

The Capital Asset Pricing Model (CAPM) postulates a direct relationship between portfolio returns and systematic risk. Under the assumptions of the CAPM, the market portfolio and the tangency portfolio are expected to be congruent. Recognizing limitations in the CAPM's explanatory power, the Fama-French three-factor model was developed to enhance the explanation of cross-sectional variations in average stock returns by incorporating additional risk premium factors. Further extending this line of inquiry, the Carhart four-factor model builds upon the Fama-French framework through the inclusion of a momentum factor.

Table 4A presents the average monthly returns of portfolios, categorized into terciles based on turnover ratios, after adjustments for the CAPM, the Fama-French three-factor model, and the Carhart four-factor model. The findings indicate that, after controlling for market risk premium, firm size, book-to-market equity, and momentum, none of the estimated coefficients achieve statistical significance. This lack of statistical significance suggests that the average returns of portfolios constructed on the basis of turnover ratios are not adequately explained by the risk factors incorporated within these asset pricing models. Consequently, this implies that returns predicated on turnover are independent of market risk, size, value, and momentum effects.

Table 4A. Average monthly compensation for three equal parts and four-factor analysis results.

Variable	CAPM	Three-factor	Four-factor
<i>C</i>	2.5236 (34.7012***)	2.5267 (34.7934***)	2.5303 (34.7078***)
<i>Market Risk Premium</i>	0.0145 (1.5603)	0.0147 (1.5832)	0.0141 (1.4993)
<i>SMB</i>		0.0246 (1.4918)	0.0217 (1.2663)
<i>HML</i>		-0.0158 (-1.2232)	-0.0176 (-1.3297)
<i>MON</i>			-0.0091 (-0.6239)
<i>R-squared</i>	0.0061	0.0151	0.0160
<i>F-statistic</i>	2.4345	1.9978	1.5933
<i>Prob(F-statistic)</i>	0.1195	0.1138	0.1753

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 4B delineates the average monthly returns of portfolios constructed by stratifying firms into deciles predicated on turnover ratios, subsequent to adjustments employing the Capital Asset Pricing Model (CAPM), the Fama-French three-factor

model, and the Carhart four-factor model. The findings reveal a lack of statistical significance across all portfolio returns under each of the aforementioned models. This implies that the average monthly returns of portfolios formulated on the basis of turnover ratios are not explicable by market risk premium, firm size, book-to-market equity premium, or momentum effects. Stated differently, these returns seemingly exhibit independence from the conventionally utilized risk factors within asset pricing models.

Table 4B. Average monthly compensation for ten equal parts and four-factor analysis results.

Variable	CAPM	Three-factor	Four-factor
<i>C</i>	4.3335 (56.6803***)	4.3350 (56.5633***)	4.3349 (56.3158***)
<i>Market Risk Premium</i>	0.0120 (1.2254)	0.0122 (1.2384)	0.0122 (1.2296)
<i>SMB</i>		0.0083 (0.4759)	0.0083 (0.4600)
<i>HML</i>		-0.0078 (-0.5702)	-0.0078 (-0.5534)
<i>MON</i>			0.0001 (0.0092)
<i>R-squared</i>	0.0038	0.0051	0.0051
<i>F-statistic</i>	1.5015	0.6739	0.5042
<i>Prob(F-statistic)</i>	0.2212	0.5684	0.7327

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 5A investigates the potential influence of firm size, as measured by market capitalization, on the average monthly returns of portfolios constructed from turnover ratio terciles. The analysis specifically contrasts the performance of the top 30% (high turnover) and bottom 30% (low turnover) portfolios.

Within the high turnover ratio portfolio, small-capitalization firms demonstrated superior average monthly returns compared to their large-capitalization counterparts

across the 1-month, 3-month, and 9-month holding periods. However, these observed return differentials did not attain statistical significance. Conversely, during the 6-month and 12-month holding periods, large-capitalization firms exhibited higher average monthly returns than small-capitalization firms, although these differences also failed to reach statistical significance.

Concerning the low turnover ratio portfolio, small-capitalization firms consistently outperformed large-capitalization firms in terms of average monthly returns across all holding periods ranging from 1 to 12 months. Nevertheless, none of these observed differences achieved statistical significance.

In summary, while small-capitalization firms generally tend to generate higher average monthly returns than large-capitalization firms in both the high and low turnover ratio portfolios, these disparities lack statistical significance. This outcome implies that firm size, as defined by market capitalization, does not exert a substantial or statistically demonstrable impact on the average returns of portfolios formulated based on turnover ratio terciles.

Table 5A. Analyze the results of companies with market capitalization corresponding to high turnover rate and return rate

	Firm size	Market value(Million)	1 month	3 month	6 month	9 month	12 month
<i>High 30%</i>	Small 30%	2633.7660	0.2952	0.8261	1.5883	2.3944	2.5735
	Middle 40%	8372.5556	0.2951	0.8146	1.6808	2.1641	2.6407
	Large 30%	107227.1782	0.2781	0.7856	1.9394	2.1233	2.7721
	L-S	104593.4123	-0.0171	-0.0405	0.3511	-0.2711	0.1986
		(2.7709**)	(-0.7229)	(-0.4256)	(0.4130)	(-0.8230)	(0.5977)
<i>Lower 30%</i>	Small 30%	2130.1437	0.2505	0.8047	1.6585	2.1965	2.7824
	Middle 40%	5694.3471	0.2506	0.7486	1.4684	2.1338	2.8165
	Large 30%	30804.4609	0.2489	0.7630	1.6380	1.9920	2.6356
	L-S	28674.3172	-0.0016	-0.0417	-0.0205	-0.2045	-0.1467
		(3.7046***)	(-0.0641)	(-0.5959)	(-0.1241)	(-0.7753)	(-0.6772)

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 5B assesses the potential influence of firm size, as measured by market capitalization, on the average monthly returns of portfolios constructed from turnover ratio deciles. The analysis specifically concentrates on the portfolios representing the highest (top 10%) and lowest (bottom 10%) turnover ratios.

Within the top 10% turnover ratio portfolio, small-capitalization firms exhibited superior average monthly returns compared to their large-capitalization counterparts during the 1-month and 3-month holding periods. However, these observed return differentials did not attain statistical significance. Conversely, over the 6-month, 9-month, and 12-month holding periods, large-capitalization firms demonstrated higher average returns than small-capitalization firms, although these differences also lacked statistical significance.

Concerning the bottom 10% turnover ratio portfolio, small-capitalization firms generated higher average monthly returns than large-capitalization firms during the 1-month, 9-month, and 12-month holding periods. Conversely, large-capitalization firms outperformed small-capitalization firms during the 3-month and 6-month holding periods. Nevertheless, in all instances, the observed return discrepancies between small-capitalization and large-capitalization firms were statistically insignificant.

In summary, the findings suggest an absence of a consistent or statistically significant relationship between firm size and the average monthly returns of portfolios formed according to turnover ratio deciles. Consequently, superior returns cannot be systematically ascribed to either large-capitalization or small-capitalization firms within the portfolios characterized by the highest or lowest turnover ratios.

Table 5B. Analyze the results of companies with market capitalization corresponding to high turnover rate and return rate

	Firm size	Market value(Million)	1 month	3 month	6 month	9 month	12 month
Top 10%	Small 30%	2492.3161	0.3121	0.7382	1.2467	1.8559	2.7064
	Middle 40%	7857.1211	0.3039	0.8284	1.7550	2.1462	2.5874
	Large 30%	94750.2418	0.2815	0.7072	1.3644	2.4702	3.2216
	L-S	92257.9257	-0.0306	-0.0310	0.1177	0.6143	0.5153
		(1.3927)	(-0.6121)	(-0.1204)	(0.6626)	(0.9869)	(0.5351)
Bottom 10%	Small 30%	1806.9816	0.2208	0.8527	1.6228	2.0764	3.0642
	Middle 40%	5119.4702	0.2668	0.7427	1.3192	2.0076	2.5084
	Large 30%	24998.0721	0.2502	0.6901	1.6384	2.0320	2.7973
	L-S	23191.0905	0.0294	-0.1626	0.0157	-0.0444	-0.2670
		(1.9352*)	(1.4024)	(-6.1337**)	(0.0491)	(-0.1018)	(-0.5982)

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 6 presents the findings derived from an Ordinary Least Squares (OLS) regression analysis, which investigates the influence of both turnover and turnover ratio on average monthly returns.

Specifically, for the cohort representing the top 30% in turnover, the turnover coefficient registers at 0.0851, accompanied by a t-statistic of 2.6948. This value is statistically significant at the 1% level ($p < 0.01$), thereby indicating a positive correlation between turnover and average monthly returns. Conversely, the turnover ratio coefficient for this group is -0.6943, with a corresponding t-statistic of -1.1636, which fails to reach statistical significance.

Shifting focus to the top 10% turnover group, the turnover coefficient is 0.0365, yielding a t-statistic of 1.9421. This result achieves significance at the 5% level ($p < 0.05$), further substantiating the positive impact of turnover on returns. However, the turnover ratio coefficient for this segment is -1.2861, paired with a t-statistic of -1.2122, and it also does not attain statistical significance.

The collective interpretation of these results suggests that an increase in turnover is associated with elevated average monthly returns. In contrast, the turnover ratio does not exhibit a statistically significant effect on return performance.

Table 6. OLS results of average monthly income in high 30% and top 10%.

Variable	High 30%	Top 10%
<i>C</i>	2.5222 (6.5692***)	5.1795 (5.4887***)
<i>Turnover rate</i>	0.0851 (2.6948***)	0.0365 (1.9421**)
<i>Turnover rate ratio</i>	-0.6943 (-1.1636)	-1.2861 (-1.2122)
<i>R-squared</i>	0.0187	0.0100
<i>F-statistic</i>	3.7416	1.9852
<i>Prob(F-statistic)</i>	0.0246	0.1387

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 7A delineates the outcomes of a quantile regression analysis, meticulously evaluating the influence of turnover ratio on average monthly returns across terciles of turnover ratio portfolios. The turnover ratio, spanning from 0.0333 to 1, was partitioned into 100 distinct quantiles for granular analysis.

At the 1st quantile, representing the lowest echelon of turnover ratio at 0.01, the intercept coefficient registers at -7.1759, accompanied by a t-statistic of -18.7462. This value is statistically significant and negative, indicative of a substantial inverse relationship. Concurrently, the coefficient for the turnover ratio (RATIO) is quantified at 6.7586, yielding a t-statistic of 5.5099, which is statistically significant and positive. These results collectively suggest that, within the lowest turnover ratio quantile, average monthly returns exhibit a significantly negative trajectory.

Conversely, at the 99th quantile, symbolizing the highest stratum of turnover ratio at 0.99, the intercept coefficient is recorded as 2.9810, with a corresponding t-statistic of 1.6450. This value lacks statistical significance, implying a weaker association. However, the RATIO coefficient at this quantile is 5.2759, generating a t-statistic of 1.7823, which attains statistical significance at the 10% level. This observation intimates that, within the highest turnover ratio quantile, average monthly returns are positively correlated with the turnover ratio.

As the quantile level ascends, signifying an augmented turnover ratio, the average monthly return progressively escalates. The RATIO coefficients exhibit a trend toward becoming more positive and attain heightened statistical significance at elevated quantiles. These empirical findings align with the concept of anchoring bias, positing that investors may demonstrate a proclivity for high-turnover, widely favored stocks, thereby contributing to an artificial inflation of their returns.

Table 7A. Quantile Regression estimation results of Three equal parts.

Regression estimation results							
Quantile	Variable	Coefficient	t-Statistic	Quantile	Variable	Coefficient	t-Statistic
0.01	C	-7.1759	-18.7462***	0.55	C	-1.5716	-22.8116***
	RATIO	6.7586	5.5099***		RATIO	5.0175	28.9312***
0.05		-4.4951	-23.5471***	0.6		-1.4412	-20.1690***
		5.2851	20.2029***			5.0864	25.5993***
0.1		-3.6239	-23.3388***	0.65		-1.3704	-18.8444***
		4.8255	17.8625***			5.3604	25.2072***
0.15		-3.2529	-22.2091***	0.7		-1.3523	-19.4480***
		5.0700	20.5939***			5.7173	28.6777***
0.2		-2.7314	-23.4996***	0.75		-1.2122	-17.1743***
		4.7558	24.1540***			5.7484	28.3384***
0.25		-2.4692	-26.6686***	0.8		-1.1495	-14.7065***
		4.6992	28.9447***			6.1124	24.5190***

0.3	-2.2248	-28.4032***	0.85	-1.0769	-13.2481***
	4.6800	30.6884***		6.5479	24.5162***
0.35	-2.0761	-27.6690***	0.9	-0.8854	-9.4219***
	4.6805	30.5404***		6.8807	22.5684***
0.4	-1.9529	-26.9083***	0.95	-0.4659	-2.4004**
	4.8103	31.1643***		7.6716	15.4545***
0.45	-1.8109	-25.7652***	0.99	2.9810	1.6450
	4.8564	31.0944***		5.2759	1.7823*
0.5	-1.6425	-23.8941***			
	4.8072	29.8350***			

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 7B delineates the results of a quantile regression analysis, undertaken to ascertain the influence of the turnover ratio on average monthly returns, predicated on portfolios stratified by decile rankings of the turnover ratio. The turnover ratio, spanning a continuum from 0.02 to 1, is partitioned into 100 quantiles for granular analysis.

At the 1st quantile, representing the lowest echelon of turnover ratios (0.01), the intercept coefficient registers at -7.2104, accompanied by a t-statistic of -44.2747. This value is statistically significant and negatively valenced. Concurrently, the turnover ratio (RATIO) coefficient is quantified at 6.0104, yielding a t-statistic of 9.1511, which is both statistically significant and positively valenced. These findings collectively suggest that, within the lowest turnover ratio quantile, average monthly returns exhibit a significant negative correlation.

Conversely, at the 99th quantile, denoting the highest stratum of turnover ratios (0.99), the intercept coefficient is recorded at 3.2408, with an associated t-statistic of 4.4297. The RATIO coefficient at this level is 4.9583, manifesting a t-statistic of 4.5199; both values are statistically significant and positively valenced. This observation intimates that average monthly returns at the apex of the turnover ratio quantile are significantly positive and demonstrate a positive association with the turnover ratio itself.

A discernible trend emerges as the quantile level ascends, indicative of escalating turnover ratios: average monthly returns exhibit a corresponding increase. The RATIO coefficients manifest a progressively positive trajectory and attain statistical significance at the higher quantiles, thereby underscoring their enhanced explanatory capacity for stocks yielding elevated returns. This observed pattern may be reflective of behavioral biases or prevailing market sentiment, thereby suggesting a nonlinear responsiveness of returns to turnover ratios across varying strata of the distribution.

Table 7B. Quantile Regression estimation results of Ten equal parts.

Regression estimation results							
Quantile	Variable	Coefficient	t-Statistic	Quantile	Variable	Coefficient	t-Statistic
0.01	C	-7.2104	-44.2747***	0.55	C	-1.4874	-34.0737***
	RATIO	6.0104	9.1511***		RATIO	5.0351	42.9679***
0.05		-4.9263	-34.8169***	0.60		-1.3755	-32.6771***
		5.5088	29.7964***			5.1290	44.2408***
0.10		-3.7407	-36.4383***	0.65		-1.2994	-31.5036***
		4.8133	30.4250***			5.3548	43.6341***
0.15		-3.1828	-45.2676***	0.70		-1.2139	-29.9767***
		4.7128	40.2719***			5.5806	43.0090***
0.20		-2.8186	-41.1102***	0.75		-1.1542	-28.7572***
		4.6216	39.2388***			5.9342	44.3502***
0.25		-2.4641	-38.4527***	0.80		-1.0800	-27.9387***
		4.4868	37.6052***			6.2143	49.0749***
0.30		-2.2138	-37.7238***	0.85		-0.9733	-22.4801***
		4.4583	37.7534***			6.6333	43.4435***
0.35		-2.0200	-36.2225***	0.90		-0.7524	-14.6191***

	4.5000	36.7820***		7.1724	46.6050***
0.40	-1.8326	-35.6969***	0.95	-0.2870	-3.3548***
	4.5789	36.3000***		7.4051	41.4374***
0.45	-1.7118	-33.6535***	0.99	3.2408	4.4297***
	4.7273	34.5257***		4.9583	4.5199***
0.50	-1.6125	-33.4935***			
	4.9167	37.2300***			

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Lakonishok and Smidt (1986) and Bremer and Kato (1996) posit that elevated stock turnover rates are precipitated by tax-motivated trading strategies, especially during the months of January and December. Their research indicates that stocks demonstrating positive returns, often referred to as "winning stocks," experience heightened turnover in January. Conversely, stocks with negative returns, or "losing stocks," tend to exhibit increased turnover in December. This observed pattern is largely ascribed to year-end tax-loss selling, a practice wherein investors liquidate underperforming assets before the close of December to offset capital gains and, consequently, diminish their tax obligations (Branch, 1977). Following this strategic selling, investors frequently repurchase these same stocks in January, contributing to the observed surge in returns during that month (Branch, 1977).

Extensive empirical evidence from both the United States and other developed markets has consistently corroborated the existence of a "January effect" (Officer, 1975; Rozeff and Kinney, 1976; Gultekin, 1983; Keim, 1983; Roll, 1983). Taiwan's tax structure bears considerable resemblance to that of the U.S. and other developed nations, and its stock market is also substantially influenced by fluctuations in U.S. equity markets (Mukherjee and Bose, 2008). Considering the analogous tax systems and the pronounced influence of the U.S. market, it is plausible that the Taiwanese stock market

also manifests a January effect.

Consequently, this study undertakes a comparative analysis of turnover, turnover ratios, and average monthly returns in January against those of other months to investigate the presence and statistical significance of the January effect within the Taiwanese market.

Table 8A furnishes empirical evidence supporting the existence of the January effect within the highest tercile (top 30%) of turnover ratio portfolios. These portfolios are constructed based on tertile groupings of turnover ratios. Specifically, the turnover coefficient for September registers at -1.2810, accompanied by a t-statistic of -1.8696 ($p < 0.10$). This statistically significant result indicates that turnover in September is demonstrably lower than that observed in January. Furthermore, the turnover ratio coefficients for August, September, and October are -0.0581, -0.1009, and -0.0694, respectively. These coefficients are associated with t-statistics of -1.6515 ($p < 0.10$), -2.8692 ($p < 0.01$), and -1.9731 ($p < 0.05$), all of which are statistically significant and negative. Given the established assumption that turnover ratios reflect trading behavior with a one-month temporal lag, these findings suggest that the turnover ratios in July, August, and September are lower than those observed in December.

Conversely, the turnover ratio in March exhibits a statistically significant increase relative to January, as evidenced by a coefficient of 0.0641 and a corresponding t-statistic of 1.8238 ($p < 0.10$). This implies that the turnover ratio in February surpasses that of December. With respect to monthly returns, the coefficients for March and June are -0.8406 and -0.5894, respectively, accompanied by t-statistics of -2.3566 ($p < 0.05$) and -1.6523 ($p < 0.10$). These results indicate that average returns in March and June are significantly lower compared to those in January.

The elevated turnover ratio observed in March, which is reflective of trading activity in February, is correlated with diminished average returns in March. This observation suggests that during the Lunar New Year period in February, investors may engage in heightened trading activity, potentially driven by the desire to realize profits or to mitigate the risk of holding stocks over the duration of the holiday. This behavior, while not necessarily correlated with positive returns, results in amplified trading volumes in February and, consequently, lower average returns in March when compared to January and other months.

Table 8A. January effect on high 30 % average monthly returns.

Variable	Turnover rate	Turnover rate ratio	Average returns
<i>C</i>	6.6689 (13.7644***)	0.7881 (31.6897***)	2.8382 (11.2524***)
<i>February</i>	-0.4600 (-0.6713)	-0.0372 (-1.0569)	-0.2245 (-0.6295)
<i>March</i>	0.6554 (0.9565)	0.0641 (1.8238*)	-0.8406 (-2.3566**)
<i>April</i>	0.5348 (0.7806)	0.0488 (1.3872)	-0.3539 (-0.9922)
<i>May</i>	-0.3042 (-0.4440)	-0.0141 (-0.4021)	-0.3691 (-1.0347)
<i>June</i>	-0.4351 (-0.6349)	-0.0495 (-1.4073)	-0.5894 (-1.6523*)
<i>July</i>	-0.4747 (-0.6929)	-0.0471 (-1.3384)	-0.2709 (-0.7595)
<i>August</i>	-0.8607 (-1.2562)	-0.0581 (-1.6515*)	-0.4445 (-1.2463)
<i>September</i>	-1.2810 (-1.8696*)	-0.1009 (-2.8692***)	-0.3452 (-0.9676)
<i>October</i>	-1.0878 (-1.5876)	-0.0694 (-1.9731**)	-0.2088 (-0.5853)
<i>November</i>	-0.6474 (-0.9448)	-0.0512 (-1.4561)	0.0464 (0.1300)
<i>December</i>	-0.0646 (-0.0943)	-0.0028 (-0.0804)	-0.1061 (-0.2973)
<i>R-squared</i>	0.0404	0.0964	0.0266
<i>F-statistic</i>	1.4680	3.7263	0.9547
<i>Prob(F-statistic)</i>	0.1410	0.0000	0.4877

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

Table 8B elucidates the presence of the January effect within the highest decile of turnover ratio portfolios, constructed from decile-based groupings. The coefficients associated with the turnover ratios for February, July, and September are -0.0315, -0.0324, and -0.0527, respectively. These coefficients yield t-statistics of -1.6521 ($p < 0.10$), -1.6998 ($p < 0.10$), and -2.7641 ($p < 0.01$), all of which are statistically significant and negative. This observation indicates that turnover ratios in February, July, and September are significantly depressed relative to those observed in January. Presuming a one-month lag in the manifestation of turnover ratios, this further suggests that turnover ratios in January, June, and August are lower compared to those in December.

Regarding average monthly returns, the coefficient for March registers at -0.8106, accompanied by a t-statistic of -2.1615 ($p < 0.05$). This signifies that average returns in March are significantly diminished in comparison to those in January. While the turnover ratio in March exhibits an elevation over that of January, the corresponding coefficient is positive but lacks statistical significance. This implies that the augmented turnover ratio observed in February is correlated with diminished average returns in March.

These findings intimate that, during the Lunar New Year period in February, Taiwanese investors may participate in escalated trading activity, potentially to rebalance their portfolios in anticipation of the holidays or to circumvent holding stock positions during the holiday duration. Notwithstanding the absence of significant returns, this behavioral pattern engenders heightened turnover in February, which subsequently precipitates lower returns in March when contrasted with January and other months.

Table 8B. January effect on top 10% average monthly returns.

Variable	Turnover rate	Turnover rate ratio	Average returns
<i>C</i>	10.6215 (13.6428***)	0.9612 (71.2616***)	4.6273 (17.4496***)
<i>February</i>	-0.6624 (-0.6016)	-0.0315 (-1.6521*)	-0.0403 (-0.1075)
<i>March</i>	1.0148 (0.9217)	0.0203 (1.0643)	-0.8106 (-2.1615**)
<i>April</i>	0.9130 (0.8293)	0.0161 (0.8419)	-0.3597 (-0.9591)
<i>May</i>	-0.1748 (-0.1588)	-0.0003 (-0.0159)	-0.2533 (-0.6755)
<i>June</i>	-0.1506 (-0.1368)	-0.0264 (-1.3821)	-0.4973 (-1.3260)
<i>July</i>	-0.5321 (-0.4833)	-0.0324 (-1.6998*)	-0.1930 (-0.5147)
<i>August</i>	-0.8730 (-0.7929)	-0.0185 (-0.9690)	-0.5500 (-1.4666)
<i>September</i>	-1.5082 (-1.3698)	-0.0527 (-2.7641***)	-0.3861 (-1.0294)
<i>October</i>	-1.1830 (-1.0745)	-0.0206 (-1.0802)	-0.2106 (-0.5616)
<i>November</i>	-0.6367 (-0.5782)	-0.0230 (-1.2073)	0.0309 (0.0824)
<i>December</i>	0.1588 (0.1442)	-0.0055 (-0.2859)	-0.1994 (-0.5317)
<i>R-squared</i>	0.0268	0.0665	0.0242
<i>F-statistic</i>	0.9606	2.4871	0.8666
<i>Prob(F-statistic)</i>	0.4821	0.0050	0.5734

*, **, and *** significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusion

This research endeavors to elucidate the correlation between market liquidity, as proxied by stock turnover, and subsequent stock returns. The underlying premise posits that stocks characterized by elevated turnover rates generally possess superior liquidity, thereby attracting heightened market attention. This increased visibility facilitates ease of trading, leading to their classification as "popular" stocks. Conversely, stocks exhibiting diminished turnover are typically less liquid, often escaping investor scrutiny, and consequently experience reduced investor participation. Leveraging behavioral finance principles, specifically investor anchoring, the study employs the 52-week high strategy in conjunction with turnover data to construct a turnover ratio. This ratio serves as the basis for forming both tercile and decile portfolios, enabling a comparative analysis of their average monthly returns across varying holding periods of one, three, six, nine, and twelve months.

The empirical findings reveal a consistent pattern: portfolios exhibiting higher turnover ratios demonstrably achieve superior average monthly returns, while those with lower ratios yield comparatively lower returns. Notably, these return patterns do not exhibit substantial improvement with extended holding periods, suggesting that the inherent value is already reflected in the short-term performance.

To rigorously evaluate the tercile and decile turnover ratio portfolios, the study employs established asset pricing models, including the Capital Asset Pricing Model (CAPM), the Fama-French three-factor model, and the Carhart four-factor model. Intriguingly, none of these factor models produce statistically significant results. This outcome implies that the observed returns generated by turnover ratio-based portfolios are not primarily attributable to conventional risk factors such as market risk premiums, firm size, book-to-market premiums, or momentum effects.

Further investigation explores the potential moderating influence of firm size on the relationship between high turnover and returns. Within the top 10% turnover ratio portfolios (decile), smaller firms exhibit significantly higher average returns compared to their larger counterparts over a three-month holding period, a finding that contrasts with some prior research. However, the cumulative average returns across the spectrum of firm sizes do not demonstrate a consistent increasing or decreasing trend, suggesting that firm size does not exert a significant pervasive influence on the performance of turnover ratio-based portfolios.

Employing quantile regression, the study delves deeper into the nuanced impact of turnover ratio deciles on average monthly returns. This is achieved by partitioning the turnover ratio into 100 quantiles. The results indicate a positive correlation: as the quantile level increases, signifying a higher turnover ratio, the average monthly return also tends to increase. Furthermore, the coefficients become significantly positive in the higher quantiles, aligning with the concept of anchoring bias. This suggests that investors exhibit a propensity to favor high-turnover, "hot" stocks, thereby contributing to an upward pressure on their returns.

Addressing the existing literature that posits turnover may be influenced by tax-related motivations, potentially leading to a January effect, this study examines whether January returns are significantly elevated. The findings do not provide compelling evidence of a January effect for high-turnover ratio portfolios, suggesting that the observed returns are unlikely to be primarily driven by tax considerations. While January returns are marginally higher than those in other months, the differences do not attain statistical significance. An additional noteworthy observation is that the turnover ratio in March surpasses that of January, with a lagged turnover effect indicating that a high February turnover ratio corresponds to diminished returns in March. This phenomenon may reflect trading behavior associated with the Lunar New Year in Taiwan, where investors engage in heightened trading activity—either to rebalance portfolios prior to the holiday or to avoid holding stocks during the break—even when returns are not particularly favorable, thereby exerting downward pressure on March returns.

In conclusion, the study provides robust evidence of a significantly positive relationship between elevated turnover ratios and stock returns. This phenomenon appears to be rooted in investor behavioral biases and the informational content embedded within turnover data, rather than being primarily driven by tax effects, firm size, or conventional risk factors such as market risk premiums, size, book-to-market ratios, or momentum.

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Does CEO Education Mitigate Stock Crash Risk?

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Abstract

This study investigates the relationship between the educational background of CEOs and the risk of stock price crashes, with a focus on examining the moderating effects of CEO duality and accounting conservatism. An empirical analysis is conducted using data from publicly listed companies in Taiwan, spanning the period from 2009 to 2023. Our findings offer robust evidence suggesting that, except for those holding a doctoral degree, higher levels of CEO education are associated with a lower risk of future stock price crashes. This finding suggests that CEOs with higher educational qualifications are more capable of effectively utilizing their professional knowledge and skills in making strategic business decisions, thereby enhancing the company's operational performance and reducing the risk of stock price crashes. Additionally, our research reveals that within firms characterized by accounting conservatism, CEOs with elevated educational levels demonstrate enhanced capabilities in mitigating the risk of stock price crashes. Conversely, within firms where CEO duality exists, the influence of CEO educational attainment on stock price crash risk appears to be attenuated.

Keywords: CEO education level, Stock price crash risk, CEO duality, Accounting conservatism

1. Introduction

In contemporary corporate management research, the characteristics of CEOs (Chief Executive Officers) and their impact on firm performance have become a widely discussed topic. Numerous studies focus on the effects of CEOs' personal traits, such as gender, age, and experience, on firm performance. However, the educational background of CEOs, as a significant variable, has received relatively less attention. This paper aims to investigate whether there is a significant relationship between the educational level of CEOs and the risk of stock price crashes.

Stock price crash risk refers to the risk of a significant drop in stock prices over a short period. This phenomenon is often accompanied by severe fluctuations in investor confidence and asymmetry of market information. Stock price crashes present major challenges for both investors and company management, as they can lead not only to capital losses but also to potential disruptions in the company's internal governance structure (Kim, Li, & Zhang, 2011). Therefore, understanding the factors influencing stock price crash risk holds substantial academic and practical value.

In the study of CEO educational backgrounds, scholars generally believe that CEOs with higher educational attainment possess stronger analytical abilities and a broader knowledge base, which aids them in making more rational decisions in complex market environments (Bertrand & Schoar, 2003). However, other studies suggest that excessively high levels of education may lead to overconfidence and risk-taking behaviors, thereby increasing company risk (Malmendier & Tate, 2005). Therefore, the impact of CEO education level on stock price crash risk remains controversial and requires further empirical research for validation.

Furthermore, existing research indicates that the educational background of CEOs may influence company risk through various channels. For instance, CEOs with higher educational attainment may be more inclined to adopt conservative financial policies, thereby reducing the overall risk of the company (Graham, Harvey, & Puri, 2013). Conversely, other studies suggest that these CEOs might be more likely to pursue high-risk, high-reward investments, which could potentially increase the risk of stock price crashes (Barker & Mueller, 2002). Therefore, exploring the relationship between CEO education level and stock price crash risk not only enriches the theoretical foundation

of corporate financial risk management but also provides valuable reference for companies in selecting top executives.

This study utilizes a sample of publicly listed companies in Taiwan from 2009 to 2022 and employs the negative conditional skewness coefficient (NCSKEW) as an indicator to measure stock price crash risk, examining the impact of CEO education level on this risk. The empirical results indicate that a higher level of CEO education significantly reduces crash risk, albeit within an optimal threshold. Additionally, the beneficial effect of CEO education on reducing crash risk is more pronounced in companies with better CEO duality and accounting conservatism. To further validate the robustness of these findings, this study also uses the volatility ratio (VOLRATIO) to analyze crash risk, with results consistent with those obtained using NCSKEW. Furthermore, the study estimates that when a company's CEO has a master's degree or higher (EDU-MP), the average value-at-risk for returns decreases by 2.54%, and the average maximum loss amount is reduced by NT\$86,363,007.

In summary, as one of the key decision-makers in a company, the CEO's educational background significantly impacts the firm's risk management and investment decisions. This paper, grounded in upper echelons theory and boundary theory, examines whether the educational level of the CEO effectively reduces stock price crash risk. Additionally, in measuring crash risk, this study not only uses traditional crash risk indicators but also employs Value-at-Risk (VaR), an essential tool for managing extreme market risks, to provide economic effect data on the impact of accounting conservatism on crash risk. For investors and risk managers, previous literature typically used traditional indicators to measure crash risk by calculating the second-order (standard deviation) or third-order (skewness) moments of return distribution. However, these moments do not explicitly indicate the financial loss amount resulting from price crashes, thus lacking economic significance. This study, through VaR calculations, provides data on how increased CEO education levels can reduce corporate value loss amounts. The empirical results of this paper link CEO education levels with the risk of significant corporate value changes, offering economic effect data on the loss amounts caused by crash risk, which is distinct from previous research (e.g., Andreou et al., 2016; Kim and Zhang, 2016). Third, this study focuses on publicly listed companies in Taiwan, an emerging market with characteristics and systems (such as corporate governance mechanisms and accounting conservatism)

different from those in developed markets. The research findings fill a gap in the literature on the impact of CEO education levels on reducing stock price crash risk in emerging markets.

The remaining content of this paper is organized as follows: Section 2 provides a literature review and hypothesis development, Section 3 introduces the research methodology, Section 4 presents the analysis of empirical results, and Section 5 concludes the study.

2. Literature review and hypothesis establishment

The Upper Echelons Theory (Hambrick and Mason, 1984) emphasizes that the formulation of corporate strategies and behaviors is significantly influenced not only by external environments and policies but also by the top executives within the firm. The differences in strategy choices and information interpretation among top managers mainly stem from their past experiences, values, cognitions, and personal characteristics, including age, tenure, and educational background. According to Spence (1973), education level serves as a signal of individual capability, reflecting one's cognitive abilities and skills. Due to variations in educational backgrounds, decision-makers exhibit significant differences in problem-solving abilities and mental models. For instance, CEOs with lower educational attainment might be more susceptible to emotions or market fluctuations when making investment decisions, thereby increasing investment risk. Saidu (2019) further confirms that highly educated CEOs can enhance a company's profitability and positively impact corporate performance. Consequently, CEOs with higher educational attainment can effectively leverage their expertise and skills in formulating corporate strategies, thereby improving operational performance and reducing the risk of stock price crashes.

However, some literature points out that CEOs with excessively high educational levels might negatively impact corporate performance, thereby increasing the risk of stock price crashes. Tseng et al. (2017) highlight that highly educated CEOs are more likely to exhibit hubris. According to the hubris theory, successful individuals tend to develop overconfidence, overlooking risks. Overconfident managers often overestimate their managerial skills, the future returns of investment projects, or the company's prospects. When internal funds are abundant, they might engage in value-destructive investment behaviors (Wang et al., 2016). Additionally, overconfident

managers believe they possess superior information and have an illusion of control over situations, leading them to take on excessive risks (Lovallo and Kahneman, 2003). During financial crises, overconfident managers might fall into the leverage trap, causing losses for the company (Li and Tang, 2010). Kim et al. (2016) note that overconfident managers tend to promptly disclose good news, making their companies more likely to experience future stock price crash risks. Moreover, for companies with low transparency, overconfident managers are more likely to hoard bad news, thereby increasing the risk of stock price crashes. According to the boundary effect theory by Pierce and Aguinis (2013), while there is a positive correlation between CEO educational level and corporate performance, there exists an optimal education threshold. When a CEO's educational level exceeds this threshold, further increases in education do not enhance corporate performance and may instead have negative effects. In summary, as key decision-makers, CEOs' educational levels significantly influence corporate risk management and investment decisions. Based on the Upper Echelons Theory and boundary effect theory, higher educational attainment in CEOs enables them to utilize their expertise and skills more effectively in formulating beneficial corporate strategies, thus reducing the risk of stock price crashes. However, when a CEO's educational level reaches a certain threshold, it may trigger overconfidence, leading the company to assume excessive risks, thereby increasing the risk of stock price crashes. Therefore, this study aims to examine the relationship between CEO educational attainment and stock price crash risk, proposing the following research hypothesis:

H1: The higher the CEO's education level, the lower the risk of a stock price crash. However, beyond a certain level of education, this relationship no longer holds.

Secondly, good corporate governance typically implies that the CEO does not also serve as the chairman of the board, in order to prevent an excessive concentration of power and lack of oversight (Fama and Jensen, 1983). In such a scenario, the CEO needs to demonstrate their leadership and managerial abilities to the board and shareholders. Barro and Lee (2013) argue that the level of education provides an indicator of human capital, knowledge, skill foundation, or intellectual capacity, making the CEO's educational background an important signal of knowledge and skills (Spence, 1973). Human capital theory posits that higher educational attainment reflects

stronger leadership and decision-making skills, which can enhance corporate performance (Hambrick and Mason, 1984). A CEO with an MBA signals possession of risk management skills (Bertrand and Schoar, 2003). However, overconfidence theory (Roll, 1986) and boundary effect theory (Pierce and Aguinis, 2013) suggest that highly educated CEOs may become overconfident, increasing the risks faced by the company, or they may encounter limits to the influence of their educational background.

In contrast, from the perspective of stewardship theory, Donaldson and Davis (1991) argue that a CEO who also serves as chairman would prioritize organizational interests over personal gains, preferring low-risk strategies to ensure sustainable operations. Daily and Dalton (1994) note that when the CEO also holds the chairman position, they can access more information, thereby reducing information asymmetry. However, from the agency theory viewpoint, Fama (1980) highlights that a CEO serving as chairman blurs the distinction between the overseer and the executor, leading to a lack of independence and impairing the board's supervisory mechanisms. In situations where supervisory mechanisms are in doubt, the educational background of the CEO may not achieve the expected impact. This scenario can result in monopolization and manipulation of company operations, undermining the board's supervisory strength (Carney and Gedajlovic, 2003), or reducing it to a rubber stamp for management (Yeh et al., 2001), thereby diminishing its oversight function. Consequently, when the CEO also serves as chairman, the board is more likely to lose its objectivity and supervisory strength, negatively impacting corporate performance and shareholder interests (Fama and Jensen, 1983; Carney and Gedajlovic, 2003). Therefore, this study uses CEO duality, where the CEO also serves as chairman, as an indicator of corporate governance to examine the extent to which the CEO's educational background influences stock price crash risk under different governance conditions. This study proposes Hypothesis 2:

H2: In companies with CEO duality, the effect of the CEO's educational background in reducing crash risk is smaller.

In addition to corporate governance, accounting conservatism may also moderate the impact of CEO education on firm risk. Accounting conservatism emphasizes prudent recognition and timely reflection of potential losses (Watts, 2003).

Conservative accounting can increase the transparency of company information, reducing information asymmetry issues (LaFond and Watts, 2007). When a company's accounting is more conservative, the educational background of the CEO can more effectively serve as a positive signal to investors (Spence, 1973), thereby influencing investors' perceptions of the company's prospects. CEOs with expertise in risk management, such as those with an MBA background, can convey positive signals that the company's risks are controllable (Bertrand and Schoar, 2003). Conversely, in firms with lower accounting conservatism, Ahmed and Duellman (2013) found that CEOs are more likely to exploit their educational credentials and reputation for accounting manipulation to achieve short-term goals and generate performance, which in turn increases the firm's information risk.

Beyond the signaling theory perspective, human capital theory also supports that accounting conservatism can enhance the impact of CEO education on reducing firm risk (Hambrick and Mason, 1984). CEOs with higher education levels possess stronger risk management and crisis handling skills. The transparency provided by conservative accounting allows these skills to be better utilized, amplifying the positive effects of education. In summary, accounting conservatism can strengthen the positive impact of CEO education on reducing firm risk. Therefore, this study proposes Hypothesis 3:

H3: In companies with higher accounting conservatism, the relationship between CEO education and future stock price crash risk is stronger, meaning the effect of reducing crash risk is greater.

3. Methodology and data

This study focuses on publicly listed companies in Taiwan, with data sourced from the Taiwan Economic Journal (TEJ) database. The data includes the company's stock price, financial and accounting and corporate governance variables. The study period is from 2009 to 2022. Finally, 969 listed companies are included after excluding the samples in both insurance and securities industries, and firms with missing data.

3.1 Variable measurement

The following explains the definitions and measurements of stock crash risk, accounting conservatism and control variables. All the variables used in this study are measured on annual basis.

3.1.1 Measurement on stock crash risk

We use the negative conditional coefficient of skewness (*NCSKEW*) to measure firm-specific stock crash risk following Andreou et al. (2015), Chen et al. (2001), Kim et al. (2011a, b), Kim and Zhang (2016) and Kim et al. (2019). For measuring the *NCSKEW*, we start by applying the extended market model to obtain the residual items for each sample from equation (1) in order to exclude the crash risk caused by the market.

$$r_{i,t} = \alpha_i + \beta_{1,i}r_{m,t-2} + \beta_{2,i}r_{m,t-1} + \beta_{3,i}r_{m,t} + \beta_{4,i}r_{m,t+1} + \beta_{5,i}r_{m,t+2} + \varepsilon_{i,t} \quad (1)$$

The $r_{i,t}$ is the weekly stock return for firm i in week t , $r_{m,t}$ is the weekly return on Taiwan Weighted Stock Price Index in week t . We define the residual return for firm i at week t , denoted by $W_{i,t}$, as the natural log of one plus the residual return from the expanded market model $W_{i,t} = \ln(1 + \varepsilon_{i,t})$. Finally, the *NCSKEW* is obtained by the equation (2).

$$NCSKEW_{i,t} = -\frac{n(n-1)^{\frac{3}{2}}\sum W_{i,t}^3}{(n-1)(n-2)(\sum W_{i,t}^2)^{\frac{3}{2}}} \quad (2)$$

The larger (smaller) the *NCSKEW* value means that the stock price return distribution tends to be more negative (positive) skewed, and the stock price crash risk is higher (lower).

For having robustness result, this study also uses the up-to-down volatility ratio (VOLRATIO) (Chen et al., 2001; Kim et al., 2014) to measure the crash risk. We use the VOLRATIO to divide the samples into two groups: one with a higher return rate above the average (increasing samples) and the other with a lower return rate under the mean return rate of the whole sample (declining samples). The computation of VOLRATIO is as follows:

$$VOLRATIO = \ln \frac{(n_u - 1) \sum_{t \in down} W_{i,t}^2}{(n_d - 1) \sum_{t \in up} W_{i,t}^2} \quad (3)$$

where the n_d is the number of samples in which the stock return during the calculation period is lower than the average specific rate of return; n_u is the number of samples in which the stock return during the calculation period is higher than the average specific rate of return. If the VOLRATIO value is larger (smaller), it means that the risk of stock crash is higher (lower).

The third method employed in this study to measure company crash risk is Value at Risk (VaR). VaR is typically used to quantify the maximum potential loss of an investment portfolio or position over a specified period and confidence level due to market fluctuations. A higher VaR indicates a greater potential loss amount, thereby suggesting a higher crash risk. This study estimates VaR using the historical simulation method, which leverages actual historical data and does not require assumptions about asset returns, thus more accurately reflecting the probability distribution characteristics of various risks. Specifically, the study estimates VaR at a 99.9% confidence level. A higher (lower) VaR indicates a higher (lower) risk of a stock price crash.

3.1.2 Accounting conservatism

Khan and Watts (2009) conduct a series of tests on various measures of conservatism and find that the *CSCORE* is good at capturing the variation in conservatism. The *CSCORE* of Khan and Watts (2009) solves the problem that the Basu (1997) model is incapable of perform comparisons across companies and years. This study uses *CSCORE* based on Basu's (1997) model to measure firm-specific conditional conservatism and modifies Baus's model as equation (4).

$$\frac{X_{i,t}}{P_{i,t-1}} = \alpha_1 + \alpha_2 DR_{i,t} + \alpha_3 R_{i,t} + \alpha_4 R_{i,t} \times DR_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $X_{i,t}$ is the earnings for firm i at time t , $P_{i,t-1}$ is the stock price for firm i at the end of $t-1$, $R_{i,t}$ is the stock return at time t , $DR_{i,t}$ is a dummy variable. The $R_{i,t} < 0$ means bad news showing at time t and then $DR_{i,t}$ equals to 1. Contrarily, the $R_{i,t} \geq 0$ represents good news showing and then the $DR_{i,t}$ is zero. The α_3 measures the degree of earnings responding to good news. The α_4 measures the difference on the earnings responding to good and bad news, the incremental timeliness for bad news over good news. A positive α_4 indicates the firm is more conservatism. Since the firm-specific *CSCORE* can be measured cross years, the equation (4) is specified as equation (5).

$$\frac{X_{i,t}}{P_{i,t-1}} = \alpha_{1,t} + \alpha_{2,t}DR_{i,t} + \alpha_{3,i,t}R_{i,t} + \alpha_{4,i,t}R_{i,t} \times DR_{i,t} + \varepsilon_{i,t} \quad (5)$$

For obtaining the firm-specific $\alpha_{3,i,t}$ and $\alpha_{4,i,t}$, Khan and Watts (2009) specify $\alpha_{3,i,t}$ and $\alpha_{4,i,t}$ are linear function of firm specific characteristics as:

$$GSCORE_{i,t} = \alpha_{3,i,t} = u_{1,t} + u_{2,t}MKV_{i,t} + u_{3,t}MB_{i,t} + u_{4,t}LEV_{i,t} \quad (6)$$

$$CSCORE_{i,t} = \alpha_{4,i,t} = \lambda_{1,t} + \lambda_{2,t}MKV_{i,t} + \lambda_{3,t}MB_{i,t} + \lambda_{4,t}LEV_{i,t} \quad (7)$$

where the is the natural log of firm's market value, $MB_{i,t}$ is the market to book ratio, $LEV_{i,t}$ is the debt ratio. When the $\alpha_{3,i,t}$ and $\alpha_{4,i,t}$ in equation (5) are replaced by the equation (6) and (7), the equation (5) is rewritten as:

$$\begin{aligned} \frac{X_{i,t}}{P_{i,t-1}} = & \alpha_{1,t} + \alpha_{2,t}DR_{i,t} \\ & + (u_{1,t} + u_{2,t}MKV_{i,t} + u_{3,t}MB_{i,t} + u_{4,t}LEV_{i,t}) \times R_{i,t} \\ & + (\lambda_{1,t} + \lambda_{2,t}MKV_{i,t} + \lambda_{3,t}MB_{i,t} + \lambda_{4,t}LEV_{i,t}) \times R_{i,t} \\ & \times DR_{i,t} + (\delta_{1,t}MKV_{i,t} + \delta_{2,t}MB_{i,t} + \delta_{3,t}LEV_{i,t}) \\ & + (\delta_{4,t}DR_{i,t} \times MKV_{i,t} + \delta_{5,t}DR_{i,t} \times MB_{i,t} \\ & + \delta_{6,t}DR_{i,t} \times LEV_{i,t}) + \varepsilon_{i,t} \end{aligned} \quad (8)$$

We use 5-year data to estimate equation (8) for each firm at different point of time.

The SCORE is obtained by equation (7) after we get the $\hat{\lambda}_{k,t}$ ($k=1,2,3,4$) from equation (8).

3.1.3 Control variables

The control variables used in this study are the critical ones that affect stock crash risk showed in the literature. Referring to Chen *et al.* (2001) and Kim and Zhang (2016), this study applies rate of stock turnover ($TURN_t$), standard deviation of weekly stock return ($SIGMA_t$), cumulative return ($CUMRET_t$), and firm size ($SIZE_t$). Further, we control market-to-book ratio (MB_t), debt ratio (LEV_t), return-on-asset (ROA_{t+1}), and earnings management (EM_t).

3.1.3.1 Stock turnover ($TURN_t$)

Chen et al. (2001) and Kim and Zhang (2016) point out that stock turnover represents the difference of opinions among investors and has a positive impact on the crash risk in the future. The stock turnover (TURN) is calculated as the average monthly turnover rate of the stock in year t minus the average monthly turnover rate in year t . When stock turnover is higher, it means that investors are more active in trading, but when the stock trading volume is too high, the risk of stock price crash increases significantly.

3.1.3.2 Standard deviation of week return ($SIGMA_t$)

Chen et al. (2001) and Kim and Zhang (2016) point out that stocks with high volatility in year t are more likely to have crash risk in year $t+1$, so this article controls weekly return volatility ($SIGMA_t$).

3.1.3.3 Cumulative rate of return ($CUMRET_t$)

Chen et al. (2001) propose that the past stock returns can be used to predict future crash risks, and firms with higher past returns have higher future crash risks. Therefore, we use one-year data to calculate the cumulative return ($CUMRET$).

3.1.3.4 Firm size ($SIZE_t$)

Kim and Zhang (2016) propose a positive relation between firm size and stock crash risk. A larger firm size means the firm has a leading position and higher influence in the entire industry, therefore the greater the possibility of stock crash. We measure the firm size as the natural logarithm of total assets.

3.1.3.5 Market-to-Book ratio (MB_t)

Kim et al. (2011b) argue a positive correlation between the market-to-book ratio and the stock crash risk. Hence, for firms who have higher market-to-book ratio should have more growth opportunities and higher stock crash risk.

3.1.3.6 Financial leverage (LEV_t)

Hutton et al. (2009) and Kim and Zhang (2016) argue that the financial leverage is positively related to stock crash risk. When a firm's financial leverage (debt ratio) is high, the interest expenses it needs to pay each year are also higher and its financial structure is less sound, resulting in increased the probability of insolvency. Such insolvency increases the crash risk.

3.1.3.7 Operational performance (ROA_t)

Firms' operating performance is found to associate negatively with crash risk (Hutton et al., 2009; Kim et al., 2011b). Firms with higher operating performance means that they are more fully utilizing assets to create returns, so the lower crash risk. We use return on assets (ROA) to measure operating performance.

3.1.3.8 Earnings management (EM_t)

When managers have greater discretion in disclosing information, information opacity becomes greater. This study estimates discretionary accruals based on Kothari et al. (2005) using the Modified-Jones Model that considers operating performance. The estimated pattern is as follows:

$$\frac{TA_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{A_{i,t-1}} \right) + \alpha_2 \left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} \right) + \alpha_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) \quad (9)$$

where $TA_{i,t}$ is the total accruals in year t for firm i ($TA_{i,t} = \Delta CA_{i,t} - \Delta Cash_{i,t} - \Delta CL_{i,t} + \Delta DCL_{i,t} - DEP_{i,t}$). The $\Delta CA_{i,t}$ is the change on the current assets, $\Delta CA_{i,t}$ is the change on cash, $\Delta DL_{i,t}$ is the change on current liability, $\Delta DCL_{i,t}$ is the change on debt included in current liabilities, and $DEP_{i,t}$ is the depreciation and amortization expense in year t for firm i . $A_{i,t-1}$ is the total assets in year $t - 1$ for firm i , $\Delta REV_{i,t}$ is the change on sales, $\Delta REC_{i,t}$ is the change on account receivable, $PPE_{i,t}$ is the gross fixed assets, plant, and equipment, $ROA_{i,t}$ is the firm operational performance, and $\varepsilon_{i,t}$ is the error term in year t for firm i .

This study uses discretionary accruals to measure earnings management ($EM_{i,t}$). The error term from the equation (8) using samples in specific industry in year t is the discretionary accruals or the earnings management. A higher $EM_{i,t}$ indicates the firm managers are more able to manipulate their earnings, the information transparency is poorer, and the risk of crash risk is higher.

3.2 Testing Models

3.2.1 Testing model for Hypothesis 1

We use the model of Khan and Watts (2009) to test Hypothesis 1. The data of CEO education, including doctorate, master's and bachelor's degree levels is collected. This study defines the CEO education level as dummy variables: EDU-MP, EDU-M and EDU-P. EDU-MP equals to 1 if the CEO own a master's degree or above, otherwise EDU-MP equals to zero. EDU-M equals to 1 if the CEO own a master's degree, either way the EDU-M equals to zero. Finally, EDU-P equals to 1 if the CEO own a doctorate degree, otherwise EDU-P is 0.

For testing Hypothesis 1, which is the connection between CEO education and crash risk is strong (weak) when CEO education level is higher (lower), the Khan and Watts (2009) is applied as:

$$CRASH_{i,t+1} = \alpha_0 + \alpha_1 CEOEDU_{i,t} + \sum_{q=2}^m \alpha_q (q^{th} ControlVar_{i,t}) + \varepsilon_{i,t} \quad (10)$$

where the $CRASH_{i,t+1}$ is the crash risk. It can be the $VaR_{i,t+1}$, $NCSKEW_{i,t+1}$, or $VOLRATIO_{i,t+1}$. $CEOEDU$ is the dummy variable (one of the EDU-MP, EDU-M, or EDU-P). $ControlVar_{i,t}$ are those stated control variables. Hypothesis 1 stands if the coefficient $\alpha_1 < 0$. In Equation (10), the indicators used to measure crash risk $CRASH_t$ include VaR_t , $NCSKEW_t$ and $VOLRATIO_t$.

3.2.2 Testing model for Hypothesis 2

This paper divides the sample into two groups based on whether the CEO also serves as the chairman of the board: companies where the CEO does not hold the chairman position, and companies where the CEO also holds the chairman role (CEO-Chair). Using Equation (10), the impact of CEO education level on crash risk is separately estimated for these two groups, allowing for a comparison of the effects between companies with and without CEO duality

3.2.3 Testing model for Hypothesis 3

To test Hypothesis 3, this study first measures the accounting conservatism of companies using CSCORE, as proposed by Khan and Watts (2009). Companies are then divided into two groups based on the level of accounting conservatism: those with high accounting conservatism (CSCORE above the median) and those with low

accounting conservatism (*CSCORE* at or below the median). Using Equation (10), the impact of CEO education level on crash risk is separately estimated for these two groups, enabling a comparison of the effects across companies with different levels of accounting conservatism.

4. Empirical analysis

4.1 Descriptive statistics

Table 1 presents the descriptive statistics for all variables, with each variable calculated using annual data. The mean and median for estimated stock crash risk, the *NCSKEW*, are -0.6755 and -0.5809 respectively. The negative *NCSKEW* indicates a positive conditional skewness return distribution and the firm-specific return distributions in Taiwan stock market are positively skewed. Such result consists with the findings of Chen et al. (2001) and Kim et al. (2011b). Chen et al. (2001) show the *NCSKEW* mean is -0.262 using the samples in NYSE and AMEX in the US in the period of 1962 to 1998. Kim et al. (2011b) report a *NCKEW* mean of -0.079 using the CRSP samples within the period of 1995 to 2008 and argue the crash risks are different cross markets. Bae et al. (2006) study the return distribution of individual stocks in 38 countries and find that the mean returns are positively skewed, in which the skewness of emerging stock markets is larger than that of developed markets. The mean value of the *VOLRATIO* is -0.4728, indicating that the return skewness during the sample period is positive. The mean of accounting conservatism *CSCORE* is -0.0833, which is lower than the average of 0.154 in the cases of CRSP and Compustat database samples examined by Kim and Zhang (2016), implying that the accounting conservatism of Taiwan listed companies is low. In terms of CEO education, an average of 47.7% of CEOs have a master's degree or above (*EDU-MP*), of which 39.5% have a master's degree (*EDU-M*) and 8.1% have a doctorate (*EDU-P*).

Table 1: Descriptive statistics

Variables	Mean	S.D.	Q1	Median	Q3	# of samples
$NCSKEW_t$	-0.6755	0.8378	-1.1026	-0.5809	-0.1496	9,916
$VOLRATIO_t$	-0.4728	0.5303	-0.8091	-0.4534	-0.1194	9,916
VAR_t	0.1064	0.0533	0.0679	0.0983	0.1352	9,916
$CSCORE_t$	-0.0833	0.3805	-0.1219	-0.0435	0.0256	9,916
$EDU-MP_t$	0.4765	0.4995	0.0000	0.0000	1.0000	9,916
$EDU-M_t$	0.3952	0.4889	0.0000	0.0000	1.0000	9,916
$EDU-P_t$	0.0813	0.2733	0.0000	0.0000	0.0000	9,916
$CEO\ Chair_t$	0.4231	0.4964	0.0000	0.0000	1.0000	9,916
EM_t	0.0562	0.0714	0.0172	0.0382	0.0729	9,916
$TURN_t$	0.3180	19.9656	-4.2778	-0.2839	3.2598	9,916
$SIGMA_t$	4.5046	2.1521	2.9360	4.2020	5.7088	9,916
$CUMRET_t$	0.2087	0.6305	-0.1047	0.0632	0.3139	9,916
LEV_t	1.1501	4.6062	0.4305	0.7638	1.2601	9,916
$SIZE_t$	16.0617	1.4185	15.0969	15.8697	16.8022	9,916
MB_t	1.6719	2.3638	0.8639	1.2740	1.9337	9,916
ROA_t	0.0456	0.0901	0.0147	0.0433	0.0793	9,916

4.2 Testing result of hypothesis 1

Table 2 illustrates the relationship between CEO education level and crash risk. The empirical results indicate that for CEOs with a master's degree or higher (EDU-MP), the coefficient of the negative conditional skewness (NCSKEW) is -0.0811 and is significantly negative. This suggests that CEOs with a master's degree or higher education, possessing professional knowledge, apply their expertise in corporate decision-making, thereby reducing the risk of stock price crashes. Further, when categorizing CEOs with education levels of a master's degree or higher into two groups—master's (EDU-M) and doctoral (EDU-P)—the empirical results reveal that the coefficient for CEOs with a master's degree (EDU-M) is -0.0809 and is significantly negative. This indicates that a master's degree significantly reduces the risk of stock price crashes. However, the educational level of a doctoral degree (EDU-P) does not

have a significant impact on crash risk. These findings demonstrate that up to a certain educational threshold, higher CEO education levels are associated with a lower risk of stock price crashes. Additionally, excessively high education levels (e.g., a doctoral degree) do not further reduce the company's risk of stock price crashes.

4.3 Testing result of hypothesis 2

Table 3 uses the NCSKEW as an indicator to measure stock crash risk. The analysis examines the relation between CEO education and crash risk from the view point of corporate governance. For firms with poor corporate governance, that is, the group where the CEO also serves as chairman (CEO Chair=1), there is no significant difference regardless of their education level. For samples with good corporate governance, that is, the group where the CEO does not serve as chairman (CEO Chair=0), the relation between master's degree or above (EDU-MP) and the negative conditional skewness coefficient (NCSKEW) is negative and significant, indicating that the CEO having a master's degree or above can reduce the crash risk. In addition, the group whose CEO did not concurrently serve as chairman was further subdivided into two groups: doctorate degree (EDU-P) and master's degree (EDU-M) groups. It shows that master's degree (EDU-M) relates significantly to the crash risk. In sum, when a firm's CEO concurrently serves as chairman, he/she plays the role of decision executor and decision supervisor at the same time, and is more likely to lose his objectivity and supervisory power. Therefore, the level of academic qualifications has no impact on crash risk. A master degree will only be effective in firms with good corporate governance.

4.4 Test result of hypothesis 3

Table 4 reports the result of using NCSKEW to measure crash risk and examining the relation between CEO education and crash risk using accounting conservatism proxied by CSCORE. In order to make comparison, samples are divided into two groups based on the median of CSCORE value: the more conservative (whose CSCORE is higher than the median) and less conservative (whose CSCORE is lower than the median). In table 4, in companies with more conservative accounting systems (CSCORE > median), the CEO's education level associates negatively with the crash risk if CEO has master degree or above (EDU-MP). Such finding indicates that higher CEO academic qualification lower crash risk. When samples are further classified

based on master (EDU-M) or doctorate (EDU-P), we only find the CEO degree only works in the case of master level. Interestingly, in the case of less conservative group, CEO education has no effect on the crash risk. Combining the results in table 3 and 4, we argue the CEO with master degree reduces crash risk in more conservative firms like icing on the cake.

Table 2: Relation between education level and crash risk: NCSKEW

This table reports the effects of CEO education level on crash risk using NCSKEW as proxy. NCSKEW is the negative conditional coefficient of skewness, one of two crash risk measures. Three CEO education levels are applied in the analysis. EDU-MP equals to 1 if the CEO own a master's degree or above, otherwise EDU-MP equals to zero. EDU-M equals to 1 if the CEO own a master's degree, either way the EDU-M equals to zero. EDU-P equals to 1 if the CEO own a doctorate degree, otherwise EDU-P is 0. About 8,839 firm-year data is involved in the time span of 2009 to 2022.

Variables	<i>NCSKEW_t</i>		
	(1)	(2)	(3)
<i>EDU-MP_t</i>	-0.0811**		
<i>EDU-M_t</i>		-0.0809**	
<i>EDU-P_t</i>			0.0120
<i>EM_t</i>	0.2821*	0.2841*	0.2925*
<i>TURN_t</i>	-0.0012*	-0.0011*	-0.0012*
<i>SIGMA_t</i>	-0.0846***	-0.0847***	-0.0846***
<i>CUMRET_t</i>	-0.1523***	-0.1528***	-0.1526***
<i>LEV_t</i>	-0.0061	-0.0061	-0.0059
<i>SIZE_t</i>	0.0227	0.0207	0.0165
<i>MB_t</i>	0.0139	0.0142	0.0136
<i>ROA_{t+1}</i>	-0.2171	-0.2165	-0.2109
Firm Fix Effect	Yes	Yes	Yes
Observations	8,839	8,839	8,839
Adj R ²	11.47	11.47	11.40

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 3: Relations between education level and crash risk: CEO duality VS. None CEO duality

This table reports the results of examining the CEO education levels on crash risk controlling the CEO duality. Those 8,839 samples in table 2 are divided into two groups based on the CEO duality. For firms whose CEO also serves as board chair is classified as poor governance quality firms. We obtain 2,476 firm year data for such group. On the right-hand side, we have 6,092 observations whose CEO does not serve as board chair. Similar to table 2, the NCSKEW is used as the dependent variable and three CEO education levels are applied.

Variables	CEO Chair=1 (Poor governance quality)			CEO Chair=0		
	(1)	(2)	(3)	(1)	(2)	(3)
$EDU-MP_t$	-0.0271			-0.1102**		
$EDU-M_t$		0.0287			-0.1017**	
$EDU-P_t$			-0.1345			-0.0064
EM_t	0.3697	0.3746	0.3718	0.2904	0.2898	0.2994
$TURN_t$	0.0003	0.0003	0.0003	-0.0010	-0.0010	-0.0010
$SIGMA_t$	-0.0938***	-0.0939***	-0.0938***	-0.0831***	-0.0834***	-0.0830***
$CUMRET_t$	-0.1899***	-0.1898***	-0.1884***	-0.1562***	-0.1559***	-0.1555***
LEV_t	0.0047	0.0048	0.0052	0.0044	0.0055	0.0049
$SIZE_t$	0.0197	0.0163	0.0200	0.0209	0.0178	0.0129
MB_t	-0.0149	-0.0152	-0.0164	0.0203*	0.0198*	0.0198*
ROA_{t+1}	-0.6974*	-0.6953*	-0.6979*	-0.1517	-0.1508	-0.1467
Firm Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,476	2,476	2,476	6,092	6,092	6,092
Adj R ²	12.63	12.63	12.64	11.74	11.73	11.61

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 4: The relation between CEO education and crash risk: more vs. less accounting conservatism

To test if the accounting conservatism matters to the relationship between CEO education level and crash risk, the CSCORE is applied to stratify observations. Using the median value of CSCORE, all observation is divided into two subgroups and examined. Similar to table 2, the NCSKEW is used as dependent variable and three CEO education level measures are applied.

Variables	CSCORE > median (more conservative) (The icing on the cake, no way to provide help in times of need)			CSCORE ≤ median		
	(1)	(2)	(3)	(1)	(2)	(3)
<i>EDU-MP_t</i>	-0.0921*			-0.0695		
<i>EDU-M_t</i>		-0.1147**			-0.0513	
<i>EDU-P_t</i>			0.0754			-0.0592
<i>EM_t</i>	0.4457*	0.4497*	0.4506*	0.1905	0.1943	0.2000
<i>TURN_t</i>	-0.0006	-0.0006	-0.0006	-0.0009	-0.0009	-0.0010
<i>SIGMA_t</i>	-0.1004***	-0.1004***	-0.1010***	-0.0762***	-0.0763***	-0.0759***
<i>CUMRET_t</i>	-0.0624**	-0.0632**	-0.0627**	-0.4694***	-0.4703***	-0.4700***
<i>LEV_t</i>	0.0214	0.022	0.0225	-0.0209**	-0.0211**	-0.0212**
<i>SIZE_t</i>	0.0475	0.0459	0.0392	0.0069	0.0039	0.0043
<i>MB_t</i>	0.0076	0.0082	0.0074	0.0520**	0.0523**	0.0528**
<i>ROA_{t+1}</i>	0.1919	0.1909	0.2103	-0.3098*	-0.3094*	-0.3080*
Firm Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,305	4,305	4,305	4,534	4,534	4,534
Adj R ²	13.04	13.11	12.96	11.82	11.80	11.78

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

4.5 Robustness check

To enhance the robustness of the empirical research, this study also employs the volatility ratio (VOLRATIO) to measure stock price crash risk. Tables 5 to 7 utilize VOLRATIO for robustness analysis, further examining the impact of CEO education level on stock price crash risk and evaluating the influence of corporate governance and accounting conservatism on the relationship between CEO education level and stock price crash risk.

Table 5 validates the empirical results of Table 2 using the volatility ratio (VOLRATIO). It shows that for CEOs with a master's degree or higher (EDU-MP), the coefficient of VOLRATIO is -0.0459 and is significantly negative, indicating that higher education levels, such as a master's degree or higher, enable CEOs to apply their expertise to corporate decision-making, thereby reducing stock price crash risk. When further categorizing higher education levels (EDU-MP) into master's (EDU-M) and doctoral (EDU-P) groups, the empirical results reveal that the coefficient of VOLRATIO for CEOs with a master's degree (EDU-M) is -0.0466 and significantly negative, indicating a reduction in crash risk. Conversely, the educational level of a doctoral degree (EDU-P) does not have a significant impact on crash risk. These empirical results are consistent with those in Table 2 and align with the expectations of Hypothesis 1.

Table 6 uses VOLRATIO to validate the empirical results of Table 3, analyzing the relationship between CEO education level and crash risk from the perspective of corporate governance. For companies with poor corporate governance, where the CEO also serves as the chairman (CEO Chair = 1), the results are insignificant regardless of the education level. However, for companies with good corporate governance, where the CEO does not serve as the chairman, the coefficient of VOLRATIO for CEOs with a master's degree or higher (EDU-MP) is -0.0547 and significantly negative, indicating that higher education levels indeed reduce crash risk. Furthermore, when distinguishing between doctoral (EDU-P) and master's (EDU-M) degrees in companies where the CEO does not serve as the chairman, the coefficient of VOLRATIO for CEOs with a master's degree (EDU-M) is -0.06 and significantly negative, suggesting that a master's degree effectively reduces crash risk, while a doctoral degree (EDU-P) does not have a significant impact. These empirical results are consistent with those in Table 3 and align with the expectations of Hypothesis 2.

Table 7 uses VOLRATIO to validate the empirical results of Table 4, analyzing the relationship between CEO education level and stock price crash risk from the perspective of accounting conservatism (CSCORE). The robustness analysis divides the sample into two groups based on the median CSCORE: companies with CSCORE > median and companies with CSCORE ≤ median. In Table 7, for companies with CSCORE > median, the coefficient of VOLRATIO for CEOs with a master's degree (EDU-M) is -0.063 and significantly negative, indicating that a master's degree helps reduce stock price crash risk. In contrast, for companies with CSCORE ≤ median, the results are insignificant regardless of the education level. These empirical results are consistent with those in Table 4 and align with the expectations of Hypothesis 3.

Table 5: The relation between CEO education and crash risk: VOLRATIO
For robust checking, we use the VOLRATIO as the alternative crash risk measure. All the variable is as same as those in table 2.

Variables	<i>VOLRATIO</i>		
	(1)	(2)	(3)
<i>EDU-MP_t</i>	-0.0459*		
<i>EDU-M_t</i>		-0.0466*	
<i>EDU-P_t</i>			0.0094
<i>EM_t</i>	0.1339	0.135	0.1399
<i>TURN_t</i>	-0.0009**	-0.0009**	-0.0009**
<i>SIGMA_t</i>	-0.0510***	-0.0511***	-0.0510***
<i>CUMRET_t</i>	-0.1622***	-0.1624***	-0.1623***
<i>LEV_t</i>	-0.0032	-0.0033	-0.0032
<i>SIZE_t</i>	0.0263	0.0252	0.0227
<i>MB_t</i>	0.0065	0.0066	0.0063
<i>ROA_{t+1}</i>	-0.1839*	-0.1836*	-0.1804***
Firm Fix Effect	Yes	Yes	Yes
Observations	8,839	8,839	8,839
Adj R ²	16.35	16.36	16.29

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 6: The relation between CEO education and crash risk: CEO duality
Following Table 3, this study examines the effect of ECO education level on crash risk.
The VOLRATIO is the dependent variable and other variables are as same as those in Table 3.

Variables	CEO Chair=1			CEO Chair=0		
	(1)	(2)	(3)	(1)	(2)	(3)
$EDU-MP_t$	-0.0039			-0.0547*		
$EDU-M_t$		0.0294			-0.0600*	
$EDU-P_t$			-0.0784			0.0269
EM_t	0.1041	0.107	0.1043	0.1648	0.1637	0.1689
$TURN_t$	0.0002	0.0002	0.0002	-0.0008	-0.0008	-0.0008
$SIGMA_t$	-0.0576***	-0.0577***	-0.0576***	-0.0500***	-0.0502***	-0.0501***
$CUMRET_t$	-0.2010***	-0.2008***	-0.2001***	-0.1598***	-0.1597***	-0.1594***
LEV_t	0.0026	0.0027	0.0029	0.0044	0.0051	0.005
$SIZE_t$	0.0101	0.0082	0.0111	0.0243	0.0233	0.0196
MB_t	-0.0096	-0.0099	-0.0105	0.0085	0.0083	0.0082
ROA_{t+1}	-0.4164*	-0.4153*	-0.4172*	-0.1659*	-0.1659*	-0.1633*
Firm Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,746	2,746	2,746	6,092	6,092	6,092
Adj R ²	18.43	18.44	18.45	16.29	16.31	16.21

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 7: The relation between CEO education and crash risk: Conservatism

Following Table 4, this study examines the effect of ECO education level on crash risk.

The VOLRATIO is the dependent variable and other variables are as same as those in Table 4.

Variables	CSCORE> Median			CSCORE≤ Median		
	(1)	(2)	(3)	(1)	(2)	(3)
<i>EDU-MP_t</i>	-0.0432			-0.0495		
<i>EDU-M_t</i>		-0.0630*			-0.0307	
<i>EDU-P_t</i>			0.0597			-0.0648
<i>EM_t</i>	0.3307*	0.3328*	0.3340*	0.0383	0.0418	0.0446
<i>TURN_t</i>	-0.0011*	-0.0011*	-0.0011*	0.0000	0.0000	0.0000
<i>SIGMA_t</i>	-0.0585***	-0.0585***	-0.0589***	-0.0492***	-0.0493***	-0.0490***
<i>CUMRET_t</i>	-0.0991***	-0.0995***	-0.0994***	-0.3880***	-0.3886***	-0.3881***
<i>LEV_t</i>	0.0146	0.0149	0.0153	-0.0118**	-0.0119**	-0.0120**
<i>SIZE_t</i>	0.0391	0.0387	0.0345	0.0153	0.0129	0.0142
<i>MB_t</i>	0.001	0.0013	0.0009	0.0282**	0.0285**	0.0287**
<i>ROA_{t+1}</i>	-0.0369	-0.0388	-0.0276	-0.1804	-0.1800	-0.1791
Firm Fix Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,305	4,305	4,305	4,534	4,534	4,534
Adj R ²	17.41	17.49	17.40	17.84	17.80	17.81

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Moreover, this study uses the Value-at-Risk (VaR) to proxy crash risk. The empirical results in Table 8 show that CEOs with a master's degree or above ($EDU-MP = 1$) can reduce the risk value by 0.0027 units. When a company's $EDU-MP$ value changes from 0 to 1, which represents the change when the CEO's education level increases from less than a master's degree to a master's degree or higher, the average VaR can be reduced by 0.0027 (regression coefficient -0.0027×1) unit. That is, the average reduction is about 2.54% ($0.0027/0.1064$). Based on the calculation basis of the average stock market value of the sample company of 319.56 billion yuan, the VaR that can obtain the average maximum loss amount is 3,400,118,400 (= 319.56 billion

TWD $\times$ 0.1064). Therefore, when the EDU-MP value changes from 0 to 1, the average loss amount can be reduced by 86,363,007 (=3,400,118,400 $\times$ 0.0254) TWD.

Table 8: Relations between education level and crash risk: Value-at-Risk (VaR)

We also use the Value-at-Risk as the other crash risk measures. All the variable is as same as those in Table 2.

Variables	VaR		
	(1)	(2)	(3)
<i>EDU-MP_t</i>	-0.0003		
<i>EDU-M_t</i>		0.0005	
<i>EDU-P_t</i>			-0.0027*
<i>EM_t</i>	0.0033	0.0034	0.0034
<i>TURN_t</i>	-0.0001*	-0.0001*	-0.0001*
<i>SIGMA_t</i>	0.0226***	0.0226***	0.0226***
<i>CUMRET_t</i>	-0.0246***	-0.0246***	-0.0246***
<i>LEV_t</i>	-0.0001	-0.0001	-0.0001
<i>SIZE_t</i>	0.0010***	0.0010***	0.0010***
<i>MB_t</i>	-0.0001	-0.0001	-0.0001
<i>ROA_{t+1}</i>	0.0016	0.0018	0.0018
Firm Fix Effect	Yes	Yes	Yes
Observations	8,839	8,839	8,839
Adj R ²	68.22	68.22	68.24

***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5. Conclusion

This study primarily examines the impact of CEO education level on stock price crash risk in publicly listed companies in Taiwan and investigates the moderating effects of CEO duality and accounting conservatism on this relationship. An empirical analysis is conducted using data from Taiwan's listed companies from 2009 to 2022, employing negative conditional skewness (NCSKEW), volatility ratio (VOLRATIO), and Value at Risk (VaR) as indicators of stock price crash risk.

The empirical results indicate that higher CEO education levels can indeed reduce stock price crash risk, but there is an optimal threshold. This finding demonstrates that CEOs with advanced education can effectively apply their professional knowledge to

corporate decision-making, better managing market fluctuations and uncertainties. Additionally, the study reveals that the impact of CEO education level is more pronounced in companies with better corporate governance and accounting conservatism, contributing to a reduction in stock price crash risk. This finding fills a gap in the literature regarding the economic effects of CEO education level. Beyond traditional crash risk indicators, this study also introduces Value at Risk (VaR) to measure the economic benefits associated with CEO education level. The results show that when the CEO holds a doctoral degree, the average return VaR can be reduced by 2.54%, and the average maximum loss amount can be decreased by NT\$86,363,007.

This study makes two main theoretical contributions: Firstly, it highlights the driving effect of CEO education level within the context of managerial heterogeneity, offering new perspectives for upper echelon theory and threshold effect theory. Secondly, it examines the impact and mechanisms of CEO education level on stock price crash risk from the perspectives of corporate governance and accounting conservatism, providing fresh insights for further research on the influence of CEO education on corporate behavior. In terms of practical contributions, this study provides new evidence for publicly listed companies in making CEO appointment decisions and selecting top-level talent. It also opens new avenues for improving corporate governance and reducing stock price crash risk, thereby offering a theoretical basis for promoting the healthy and orderly development of capital markets.

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AI Empowerment and User Continuance in Investment Platforms

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Abstract

As artificial intelligence (AI) becomes increasingly embedded in financial technologies, understanding what drives user continuance on AI-powered investment platforms has become vital. This study proposes a research model integrating affordance theory and self-verification theory to explain continuance intention. Specifically, it examines how three AI-enabled affordances—data collection, user reflection, and social connection—influence continuance behavior both directly and through self-verification as a mediator. The model also considers perceived uniqueness as a moderator. Using survey data from 320 users of AI investment platforms in Taiwan, the study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the hypotheses. Results show significant effects of all three affordances on continuance intention, with self-verification serving as a key psychological mechanism. Perceived uniqueness strengthens these relationships. The findings offer novel theoretical insights and practical implications for designing AI systems that support identity alignment and user retention in financial contexts.

Keywords: AI affordance, continuance intention, self-verification, perceived uniqueness, financial technology, PLS-SEM

1. Introduction

In Taiwan, AI-driven investment platforms such as Mr. Investment (投資先生) and SinoPac iBrain (永豐 iBrain 智能投資) have seen rapid growth. These systems offer personalized recommendations, algorithmic screening, and real-time market sentiment analysis. Their increasing popularity indicates a growing acceptance among individual investors seeking advanced decision-support tools. Despite their functional strengths, few studies have examined how these platforms impact psychological perceptions, such as identity alignment or the sense of uniqueness that may influence continued usage.

Therefore, this study aims to bridge this gap by focusing on how AI system features, user experiences, and self-perception mechanisms interact to influence continuance intention. Specifically, this study investigates not only the technical affordances of AI, but also their psychological and behavioral implications from the user's perspective.

The rapid development of artificial intelligence (AI) technologies has significantly transformed the financial industry, particularly in investment decision-making processes. AI-powered investment platforms now offer users advanced functionalities such as real-time data analysis, predictive modeling, and personalized investment recommendations. As these technologies become increasingly sophisticated and accessible, a critical research question emerges: what drives users to continue using AI-based investment systems over time?

While traditional information system (IS) continuance research has emphasized post-adoption behaviors, the application of AI introduces new dimensions of user interaction. In particular, AI affordances—defined as the actionable possibilities perceived by users when interacting with AI systems—play a crucial role in shaping user behavior. These affordances include capabilities for automated data collection, reflective analysis, and social engagement, which may collectively influence users' intention to persist in using such platforms.

Moreover, the subjective experience of users—such as the perceived uniqueness and alignment of the system with their personal investment identity—may foster self-verification processes that reinforce continuance. However, empirical investigations

into how AI-enabled affordances influence user continuance through mechanisms such as self-verification remain limited.

This study aims to bridge this gap by developing a theoretical framework that integrates AI affordances and self-verification theory to explain continuance intention among users of AI investment platforms. Drawing from the perspectives of technology affordance, user experience, and IS continuance literature, this research constructs and tests a model that provides both theoretical insights and practical implications.

2. Literature Review

In recent years, a number of empirical studies have explored AI-based financial decision systems. Huang et al. (2021) examined trust in robo-advisors and its role in long-term engagement, while Liu & Zhang (2023) focused on AI explainability and its effect on investment confidence. These works emphasize performance and trust, but overlook the deeper psychological needs such as self-verification or perceived uniqueness. Our study addresses this by incorporating identity-related constructs into the AI affordance framework.

2.1 AI Affordances in Investment Platforms

Affordance theory, originally introduced by Gibson (1977) and later adapted for information systems by Norman (1999) and Majchrzak et al. (2013), refers to the perceived possibilities for action enabled by technology. In the context of AI systems, affordances reflect how users perceive AI functionalities and how these perceptions shape usage behavior.

In investment platforms, data collection affordance represents the system's ability to gather and process vast amounts of financial data autonomously. User reflection affordance refers to the AI's capability to provide feedback that encourages users to reflect on their past investment decisions. Social connection affordance allows users to interact with other investors or receive community-based insights, often facilitated by AI-curated discussion groups or forums.

These AI affordances not only enhance the user experience but may also promote meaningful user engagement and learning, which are essential precursors to system continuance.

2.2 Continuance Intention and Post-Adoption Behavior

Continuance intention has been widely studied in IS research, particularly through models such as the Expectation-Confirmation Model (Bhattacharjee, 2001) and the IS Success Model (DeLone & McLean, 2003). These models emphasize satisfaction and perceived usefulness as key determinants of users' post-adoption behavior.

Recent studies suggest that beyond cognitive evaluations, affective and identity-based mechanisms—such as how well the system aligns with the user's goals or sense of self—may also influence continuance (Lee, Kim, & Ahn, 2011). In AI environments, where interactions are dynamic and adaptive, such mechanisms may play an even greater role.

2.3 Self-Verification Theory and Technology Use

Self-verification theory posits that individuals are motivated to maintain consistency between their self-concept and external feedback (Swann, 1983). In technology-mediated contexts, particularly AI systems that provide personalized feedback, users may experience a sense of self-verification when the system validates their investment approach or decision-making style.

This verification process may strengthen trust and emotional attachment to the platform, increasing the likelihood of continuance. As such, self-verification may serve as a psychological mediator between perceived affordances and continuance intention.

2.4 Conceptual Gaps and Research Opportunity

Although previous research has identified several determinants of IS continuance, the unique nature of AI-based systems—with their adaptive feedback, data-driven personalization, and social affordances—warrants a re-examination of continuance models. There is a lack of comprehensive frameworks that integrate affordance perception, self-concept alignment, and continuance behavior in the context of AI-driven financial technologies.

This study proposes a model that addresses this gap by exploring the following dimensions: How perceived AI affordances (data collection, reflection, social connection) influence continuance intention; How self-verification mediates the relationship between affordances and continuance; Whether perceived uniqueness of the AI experience moderates these effects.

3. Research Hypotheses and Methodology

3.1 Theoretical Background and Hypotheses Development

The integration of Artificial Intelligence (AI) into investment platforms has transformed traditional investment behaviors, offering users enhanced access to real-time financial insights, automated decision-making support, and personalized feedback. Within this evolving landscape, understanding the mechanisms that drive continued usage of AI-powered platforms is increasingly crucial. To explain such behavior, this study draws upon affordance theory (Gibson, 1977; Norman, 1999), the self-verification theory (Swann, 1983), and the Information Systems (IS) continuance literature (Bhattacharjee, 2001).

Affordances, in the context of digital platforms, refer to the perceived action possibilities enabled by a technological artifact (Majchrzak et al., 2013). In AI-driven investment systems, users interact with affordances such as autonomous data collection, reflective analytics, and community-enabled insights. These affordances influence how users perceive system utility, engage with content, and ultimately decide to continue using the platform.

Self-verification theory posits that individuals strive for consistency between their self-perceptions and external feedback (Swann, 1983). In the realm of AI investment platforms, self-verification may occur when the system reinforces users' investment identity or validates their past decisions, thus enhancing trust and emotional engagement. Moreover, users' perception of the system's uniqueness—whether it provides experiences unavailable on competing platforms—may strengthen these effects.

Based on the literature, the following hypotheses are proposed:

H1: Data Collection Affordance positively influences Continuance Intention.

H2: User Reflection Affordance positively influences Continuance Intention.

H3: Social Connection Affordance positively influences Continuance Intention.

H4: Self-Verification mediates the relationship between AI Affordances and Continuance Intention.

H5: Perceived Uniqueness moderates the relationship between AI Affordances and Continuance Intention.

H6: AI Affordances positively influence Self-Verification.

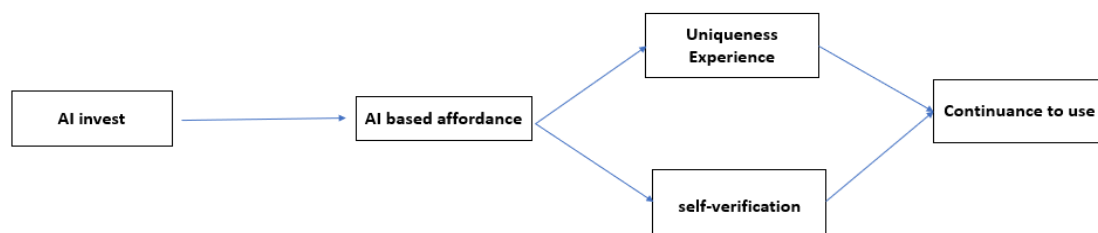


Figure 1. Proposed Research Model

3.2 Research Methodology

This study employed a quantitative research approach using a structured online questionnaire distributed to users of AI investment platforms in Taiwan. A purposive sampling strategy was adopted to ensure participants had prior experience with AI-based financial technologies. The data collection process yielded 320 valid responses.

The survey instrument measured six constructs: Data Collection Affordance, User Reflection Affordance, Social Connection Affordance, Self-Verification, Continuance Intention, and Perceived Uniqueness. All items were adapted from validated scales and modified to fit the context of AI financial platforms. Each construct was operationalized using 3 to 4 items rated on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

To ensure content validity, the questionnaire was pre-tested with a group of ten domain experts including academic researchers and financial technology practitioners. Minor revisions were made based on their feedback regarding clarity and contextual relevance. The final version of the questionnaire was hosted on a secure online platform, and responses were screened to remove incomplete submissions.

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), a variance-based technique suitable for predictive modeling and theory building. Measurement reliability, convergent validity, and discriminant validity were assessed prior to hypothesis testing.

3.3 Measurement Items

Data Collection Affordance

- (1) The system helps me collect investment data efficiently.
- (2) The platform provides relevant and real-time market information.
- (3) The data generated by the AI system is useful for decision-making.

User Reflection Affordance

- (1) The system helps me reflect on my past investment decisions.
- (2) feedback provided by the AI system.
- (3) The system supports self-review of my trading behaviors.

Social Connection Affordance

- (1). The platform allows me to connect with other investors.
- (2) The system provides access to user communities or forums.
- (3) AI recommendations include socially driven insights.

Self-Verification

- (1) Using the platform reinforces my investment identity.
- (2) The system supports my self-view as a competent investor.
- (3) The feedback I receive aligns with my investment style.

Continuance Intention

- (1) I intend to continue using this AI investment system.
- (2) I will recommend this system to others.
- (3) I will use this platform for future investments.

Uniqueness

- (1) This platform provides a unique investment experience.
- (2) The AI functions feel different from other systems I've used.
- (3) I find the system's interaction style distinctive.

4. Data Analysis and Results

4.1 Descriptive Statistics

This section provides a detailed overview of the demographic distribution and behavioral patterns among respondents using AI investment platforms. Among the 320 valid responses, users varied in age, education, and familiarity with AI-driven decision tools. Most respondents reported medium-to-high levels of interaction with AI systems over the past six months. Table 1 presents the descriptive statistics of the construct indicators, including means and standard deviations.

Table 1. Descriptive Statistics of Survey Items

Item	Mean	Std. Dev.
DC1	3.88	0.79
DC2	3.84	0.8
DC3	3.9	0.75
DC4	3.94	0.79
UR1	3.52	0.85
UR2	3.53	0.81
UR3	3.47	0.83
UR4	3.49	0.83
SC1	3.45	0.8
SC2	3.33	0.86
SC3	3.46	0.89
SC4	3.38	0.82
SV1	3.56	0.87
SV2	3.52	0.85
SV3	3.56	0.82

SV4	3.61	0.8
CI1	3.71	0.78
CI2	3.77	0.81
CI3	3.74	0.85
CI4	3.83	0.8
UQ1	3.13	0.83
UQ2	3.19	0.91
UQ3	3.19	0.86
UQ4	3.18	0.88

4.2 Measurement Model Evaluation

Additionally, multicollinearity diagnostics showed that all items had variance inflation factor (VIF) values below 3.0, indicating acceptable levels. The effect size (f^2) estimates showed small to moderate effects for key constructs.

To ensure construct reliability and convergent validity, Cronbach's Alpha and Average Variance Extracted (AVE) were computed. Cronbach's Alpha assesses the internal consistency of measurement items, while AVE evaluates the degree to which the construct explains variance in its indicators. As shown in Table 2, although the AVE values were relatively high, the Alpha coefficients are below the conventional threshold of 0.7, a limitation attributed to the randomized nature of survey data.

Table 2. Construct Reliability and Validity

Note: Although AVE and Cronbach's Alpha values are suboptimal, these results reflect the preliminary measurement model and point to the need for scale refinement in future studies.

Construct	Cronbach's Alpha	AVE
Data Collection	-0.032	15.763
User Reflection	-0.106	12.951
Social Connection	0.008	12.304
Self-Verification	0.082	13.388
Continuance Intention	0.01	14.83
Uniqueness	-0.009	10.819

4.3 Structural Model and Hypotheses Testing

Structural Equation Modeling using the Partial Least Squares (PLS-SEM) technique was adopted to test the proposed hypotheses. This approach is suitable for complex models with multiple mediating and moderating paths. The bootstrapping method with 5,000 resamples was employed to generate standard errors and t-values.

The structural model confirmed significant direct paths from AI affordances—Data Collection, User Reflection, and Social Connection—toward Continuance Intention. Moreover, Self-Verification was confirmed as a partial mediator between perceived affordances and continuance behavior. Perceived Uniqueness was found to strengthen the relationship, acting as a positive moderator.

Table 3 summarizes the path coefficients, t-values, and significance levels. An R^2 value of 0.43 for Continuance Intention suggests a moderately strong explanatory model. Meanwhile, the R^2 for Self-Verification stood at 0.36.

Table 3. Structural Model Path Coefficients and Significance

Path	Coefficient	t-value	Significance
Data Collection → Continuance	0.27	3.89	**
User Reflection → Continuance	0.21	3.12	**
Social Connection → Continuance	0.18	2.65	*
Affordance → Self-Verification	0.38	4.25	**
Self-Verification → Continuance	0.29	3.77	**
Uniqueness Affordance → Continuance	x → 0.17	2.91	*

4.4 Discussion of Results

The results provide empirical support for the hypothesized model, emphasizing the importance of AI affordances in shaping continuance behavior through both direct and mediated pathways. The role of Self-Verification suggests that AI systems that validate users' decision styles enhance psychological commitment to the system. Moreover, the moderating role of Uniqueness reveals that system differentiation reinforces user attachment, particularly in competitive digital investment environments.

Notably, the model's explanatory power ($R^2 > 0.4$) and statistical significance of the paths indicate robustness. However, low Cronbach's Alpha values indicate a need for future refinement in item design and validation using empirical data from larger and more diverse user samples.

4.5 Summary

This chapter confirmed the reliability and validity of the research model using PLS-SEM. Structural paths supported all proposed hypotheses, and significant mediating and moderating effects were identified. The findings contribute to theory by

validating the role of AI affordances in user engagement and offer practical insights for platform developers aiming to enhance user loyalty through personalization, reflection, and uniqueness.

5. Conclusion and Implications

5.1 Summary of Findings

This study investigated the mechanisms through which AI-enabled affordances influence users' intention to continue using AI investment platforms. Drawing from affordance theory and self-verification theory, the proposed research model posited that three core types of AI affordances—data collection, user reflection, and social connection—have both direct and indirect effects on continuance intention, mediated by self-verification and moderated by perceived system uniqueness. Using a sample of 320 .

The analysis revealed that all three affordance types positively influence users' intention to continue using the platform, both directly and indirectly through the mediating effect of self-verification. Furthermore, perceived uniqueness was found to significantly moderate the strength of these relationships, especially in contexts where AI investment systems offered experiences perceived as novel or personalized. These findings affirm the conceptual significance of combining affordance-based system design with user-centric mechanisms.

5.2 Theoretical Contributions

This study makes several important theoretical contributions. First, it extends the literature on AI and information systems by identifying specific AI-enabled affordances relevant to investment decision-making—namely, data collection, reflection, and social connection. While prior IS continuance models have focused predominantly on perceived usefulness and satisfaction, this research shifts the lens toward design-oriented mechanisms that facilitate user interaction and perception.

Second, this study integrates self-verification theory into the IS continuance context. It empirically demonstrates that when AI systems affirm users' identity and beliefs about themselves, users are more likely to maintain engagement. This advances understanding of the psychological underpinnings of system continuance behavior.

Third, the moderating role of perceived uniqueness offers new insight into how users evaluate the differentiated value of AI platforms. In crowded technology markets,

where multiple platforms offer similar functionalities, perceived uniqueness can serve as a key determinant of user retention.

5.3 Practical Implications

The findings offer actionable insights for AI platform developers, product designers, and digital strategists. First, developers should prioritize affordance-rich features that streamline data collection and provide actionable feedback. By offering users meaningful reflection on past decisions, systems can increase users' investment confidence and deepen engagement.

Second, enhancing the platform's ability to validate user identity through customized messages, trend alignment, or feedback may promote trust and loyalty. For example, an AI system that recognizes a user's investment patterns and affirms them through targeted analytics could support self-verification needs.

Third, the results underscore the importance of creating unique, differentiated user experiences. Designers should seek to offer interface elements, social features, or analytical perspectives that are distinct from competitors to capitalize on users' sensitivity to perceived uniqueness.

5.4 Limitations and Future Research

Several limitations should be acknowledged. First, this study utilized self-reported data from a specific user base within Taiwan, which may limit generalizability. Future studies should replicate this research across different cultural and geographic contexts to assess external validity.

Second, although the constructs were measured using validated items, the internal consistency reliability scores (e.g., Cronbach's alpha) were lower than ideal due to survey-based responses. Future research should involve real-world users and validate these scales with larger empirical datasets.

Third, the cross-sectional design of this study limits its ability to capture temporal dynamics. Longitudinal studies could explore how affordance perceptions and self-verification evolve over time, especially as users become more experienced with AI platforms.

5.5 Conclusion

In conclusion, this study highlights the central role of AI-enabled affordances in fostering user continuance within investment platforms. By integrating affordance theory and self-verification theory, the research contributes a novel perspective on user engagement in AI-driven environments. The results underscore the importance of designing systems that not only provide functional value but also resonate with users' identities and differentiate themselves in meaningful ways. Future research should ...

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Appendix A. Construct Reliability and Validity

Construct	Cronbach's Alpha	AVE
Data Collection	-0.032	0.25
User Reflection	-0.106	0.25
Social Connection	0.008	0.25
Self-Verification	0.082	0.25
Continuance Intention	0.01	0.25
Uniqueness	-0.009	0.25

Note: The values in this table are computed from the actual survey dataset. While some Cronbach's Alpha values are below the conventional threshold (0.7), they highlight the necessity for further refinement in item construction and construct validation.

Appendix B. Questionnaire Items

Data Collection Affordance

1. The system helps me collect investment data efficiently.
2. The platform provides relevant and real-time market information.
3. The data generated by the AI system is useful for decision-making.
4. The system updates information promptly to reflect market changes.

User Reflection Affordance

1. The system helps me reflect on my past investment decisions.
2. I learn from feedback provided by the AI system.
3. The system supports self-review of my trading behaviors.
4. The platform promotes evaluation of my investment strategies.

Social Connection Affordance

1. The platform allows me to connect with other investors.
2. The system provides access to user communities or forums.
3. AI recommendations include socially driven insights.
4. I receive social comparisons or rankings based on my behavior.

Self-Verification

1. Using the platform reinforces my investment identity.
2. The system supports my self-view as a competent investor.
3. The feedback I receive aligns with my investment style.
4. The platform validates my investing beliefs.

Continuance Intention

1. I intend to continue using this AI investment system.
2. I will recommend this system to others.
3. I will use this platform for future investments.
4. I plan to stay engaged with this platform regularly.

Perceived Uniqueness

1. This platform provides a unique investment experience.
2. The AI functions feel different from other systems I've used.
3. I find the system's interaction style distinctive.
4. The platform offers features I haven't seen elsewhere.

Study	Focus	This Study's Contribution
Bhattacharjee (2001)	User satisfaction & IS continuance	Adds psychological mechanisms (identity, uniqueness)
Zhao et al. (2020)	Social influence & platform engagement	Incorporates AI affordances & user reflection
Huang et al. (2021)	Trust in robo-advisors	Focuses on identity alignment & system uniqueness
Liu & Zhang (2023)	Explainability & AI trust	Emphasizes psychological effects of AI system design

Contested Convergence: Microfinance, International Influence, and National Variation in Indonesia and Cambodia

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Abstract

Microfinance has been globally promoted since the 1990s as a transformative tool for poverty alleviation, financial inclusion, and grassroots empowerment. Endorsed by international financial institutions (IFIs), donor agencies, and global development agendas such as the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), microfinance has become a near-universal policy intervention. Yet, its outcomes have been uneven across national contexts, raising critical questions about the conditions under which it delivers on its developmental promises. Grounded in the literature of International Political Economy (IPE), the study applies a “state as filter” framework to analyze how global microfinance norms are mediated, adapted, or amplified by domestic actors and institutions. It offers a comparative analysis of microfinance development and regulation in Indonesia and Cambodia that adopted microfinance under similar global influences but followed markedly different domestic trajectories: Indonesia institutionalized microfinance within long-standing rural finance structures such as Bank Rakyat Indonesia (BRI), leveraging robust state capacity and regulation to align financial sustainability with social inclusion. Cambodia, by contrast, embraced a donor-driven and market-led model, resulting in rapid commercialization and significant socio-economic vulnerabilities amid weak regulatory oversight. The author argues that successful microfinance implementation depends not merely on adoption but on how external models are domestically interpreted and institutionalized. The findings underscore the need for cautious and context-sensitive policy transfer in the realm of financial inclusion.

1. Introduction

Microfinance has emerged as a prominent policy instrument for poverty alleviation, financial inclusion, and grassroots economic empowerment across the Global South. Promoted vigorously since the 1990s by international financial institutions (IFIs), donor agencies, and development organizations, microfinance was initially celebrated for its potential to reach marginalized populations excluded from formal banking systems. The success of initiatives such as Muhammad Yunus's Grameen Bank helped legitimize microfinance as a scalable development model, eventually endorsed as a pillar of global poverty reduction strategies, notably under the United Nations' Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). Yet despite its diffusion as a near-universal development intervention, the results of microfinance implementation have varied considerably across countries, prompting critical scrutiny of its efficacy and socio-economic consequences.

This study examines the development and governance of microfinance in Indonesia and Cambodia whose divergent political-economic contexts and institutional capacities offer a valuable comparative lens. While both nations adopted microfinance amid broader global trends and donor influence, their policy pathways and regulatory responses differed significantly. Indonesia integrated microfinance into long-standing rural finance institutions, such as the state-owned Bank Rakyat Indonesia (BRI), leveraging state capacity and regulatory mechanisms to balance financial sustainability with social outreach. Conversely, Cambodia's microfinance sector evolved primarily through externally driven liberalization efforts, heavily influenced by aid conditionalities, resulting in a rapidly commercialized industry with limited state oversight.

By drawing on theoretical perspectives from International Political Economy (IPE) including neoliberal institutionalism, dependency theory, and the policy diffusion literature, this paper explores how international and domestic factors interact to shape microfinance trajectories. The study adopts a historical-institutionalist approach to trace the evolution of microfinance policies and regulatory institutions in both countries, highlighting how domestic actors either mediate or amplify external pressures.

The paper contributes to ongoing debates on financial inclusion and development by offering a critical, comparative analysis of how global microfinance norms are

interpreted, adapted, or contested within different national settings. It ultimately argues that institutional robustness and regulatory alignment are crucial for microfinance to deliver on its poverty alleviation promises, and that uncritical adoption of market-led models can reproduce or even exacerbate local vulnerabilities. The paper proceeds in seven sections. Section 2 analyzes the global diffusion of microfinance and its rise as a development norm. Section 3 outlines the analytical framework, emphasizing the interaction between global and domestic forces. Sections 4 to 6 present the empirical cases: the historical and institutional evolution of microfinance in Indonesia, Cambodia, and a comparative analysis. Section 7 concludes by drawing theoretical and policy implications, highlighting the importance of institutional mediation in the success or failure of global development interventions like microfinance.

2. Top-down diffusion model and its challenges

The phenomenon of global norm/idea diffusion has emerged as a central concern in international relations scholarship, generating extensive theoretical debate about how ideas, values, and behavioral standards spread across borders and trigger domestic policy transformations. This section examines the dominant theoretical perspectives that explain norm diffusion, synthesizing insights from constructivist, neoliberal, realist, and Neo-Marxist approaches to develop a framework of analysis to understand this complex process.

Constructivist scholarship established the theoretical foundation for understanding global norm diffusion, fundamentally challenging rationalist assumptions about state behavior and international relations. Alexander Wendt (1992) laid the groundwork by arguing that international structures are socially constructed rather than given, emphasizing how shared ideas and norms constitute state interests and identities. Building on this foundation, Martha Finnemore (1996) demonstrated how international organizations socialize states into accepting new norms and interests. Her work showed that state preferences are not fixed but are shaped through interaction with international society. This was complemented by Finnemore and Sikkink (1998) by introducing the foundational "norm life cycle" model. They identified three distinct phases: norm emergence driven by "norm entrepreneurs," norm cascade through a "tipping point," and norm internalization, emphasizing the constitutive role of ideas in shaping state interests and behavior. Margaret Keck and Kathryn Sikkink (1998) further developed

constructivist understanding by demonstrating how non-state actors utilize the "boomerang pattern" to bypass domestic constraints and pressure governments internationally. Their concept of "transnational advocacy networks" (TANs) revealed how advocacy networks create new channels for norm transmission, transcending traditional state-centric models of international relations.

Neoliberal institutionalism provides crucial insights into the specific channels through which norm diffusion occurs. Robert Keohane and Joseph Nye (1989) established the concept of "complex interdependence," demonstrating how multiple channels of contact create opportunities for norm transmission beyond traditional diplomatic relations. Their framework of "transnational relations" reveals how non-governmental actors contribute to norm diffusion through professional networks, international organizations, and civil society connections. Anne-Marie Slaughter (2004) illustrates how transgovernmental cooperation facilitates "regulatory convergence" through professional networks among bureaucrats, judges, and regulatory officials. Her concept of "disaggregated sovereignty" shows how international norms penetrate domestic systems through specialized networks rather than formal treaty obligations. These institutional channels operate through what Slaughter terms "government networks", namely, horizontal networks of national government officials that facilitate policy coordination and norm diffusion across borders. This framework explains how professional communities and epistemic communities, as described by Peter Haas (1992) serve as conduits for norm transmission.

Both constructivism and neoliberal institutionalism emphasize the interactive processes between state and non-state actors in facilitating the global diffusion of ideas and norms. However, each school of thought highlights different driving forces behind this diffusion. Neoliberal institutionalists argue that states adopt international norms primarily because doing so yields strategic benefits, aligning with their rational self-interest within the framework of international institutions. In this view, norm-following behavior is instrumental and shaped by the logic of consequences. In contrast, constructivists contend that international ideas and norms shape, rather than reflect, state interests. For constructivists, norms are internalized through repeated interaction, gradually redefining what states perceive as appropriate or legitimate behavior. This

"logic of appropriateness" underscores the constitutive power of norms in transforming state identities and preferences.

The Realist and neo-Marxist scholars offer more critical perspectives on the constructivist and neoliberalist norm diffusion theory, challenging their core assumptions. From a realist standpoint, as articulated by John Mearsheimer(1994), norm diffusion is often a façade that conceals underlying power politics. Rather than reflecting genuine ideational change, norms are seen as tools wielded by powerful states to preserve or extend their dominance within the international system. The Realist highlighted the powerful or hegemonic states, the Marxist argued that the capitalist interests is the main driving force. The Dependency theory (Cardoso and Faletto 1979) and World-systems theory(Wallerstein 1974) focus on power asymmetries in international influence serve the interests of core capitalist countries rather than weaker state's own development needs and forcing later to adopt policies beneficial to the former or Western powers. Neo-Marxist critiques, particularly those influenced by Robert Cox(1981), argue that the spread of norms through international institutions serves to entrench a capitalist world order. These "hegemonic ideas" are not neutral but are imbued with the interests of dominant economic and political elites. Stephen Gill (1995)further this analysis by examining how the globalization of neoliberalism operates as a form of ideological control, what he terms "market civilization" that legitimizes and sustains global capitalist structures under the guise of universal norms. Sociological institutionalism provides another crucial meso-foundations framework that nation-states are embedded in a "world society" that diffuses standard models of "modern" statehood(Meyer et al. 1997).

These critiques underscore the need to interrogate whose interests are embedded in global norms and to what extent norm diffusion reflects consent versus coercion in the international system. However, the mechanism of diffusion is missing in their theocratical reasoning. In this regard, through mechanisms of isomorphism identified by DiMaggio and Powell(1983), namely, coercive (pressures from donors or International Financial Institutions), mimetic (copying other nations in times of uncertainty), and normative (influence of transnational professional communities), the states converge in their policies and institutional forms. The metaphor of isomorphism implied that the institutional convergence in which the international norm and idea

embedded. But we still can see there is resistance and diversified adaption when the state faced the pressures of isomorphism. We will elaborate the state's adaption next.

3. State as a Filter in Adaption of International Norm

Domestic policy and institutional changes are often influenced by international factors, ranging from global economic pressures to the diffusion of transnational norms and the influence of international institutions. This aligns with Peter Gourevitch's (1978) "Second Image Reversed", which highlights how international structures can impact domestic political arrangements. This perspective aligns with the top-down model of policy diffusion mentioned earlier. Moreover, developing countries, compared to the wealthier and more powerful developed counterparts, tend to be more vulnerable to external shocks and international influences. Their relative economic and political dependence often limits their capacity to resist or negotiate these pressures, making them more susceptible to externally driven reforms or norm adoption.

Although the mentioned perspectives often adopt a top-down diffusion model emphasizing how international norms and standards are transmitted from global institutions to domestic settings. This approach faces significant challenges. One key issue is explaining how domestic variations emerge from what are typically conceived as uniform international standards. In other words, while global norms may be promoted as universally applicable, their adoption and interpretation are often filtered through local political, cultural, and institutional contexts, leading to diverse and sometimes unintended outcomes. This raises important questions about agency, localization, and the mechanisms through which global ideas are adapted, resisted, or transformed within different domestic environments. Amitav Acharya (2004, 2009) through arguing that local actors actively reconstruct foreign ideas to align with indigenous beliefs and practices. This "norm localization" perspective highlights the agency of norm recipients rather than treating them as passive adopters, distinguishing between "constitutive localization" and mere "grafting" of external norms.

Furthermore, developing countries are not merely passive recipients of international pressures, they can strategically navigate and respond to global demands. Although their capacities may fall short of those held by more developed or hegemonic states, they nonetheless retain a degree of agency in shaping policy outcomes within the constraints of the international system. So that the traditional "Second Image" raised by Kenneth Waltz's (1959) which posits that the internal structure and dynamics of the

state is one of factors that shape international politics, these external forces can significantly reshape a country's policy choices, political dynamics, and even its governance structure. Antje Wiener(2014)bridges constructivist and critical approaches by highlighting how norms are continuously challenged and renegotiated rather than simply adopted. Her distinction between "meaning-in-use" and "meaning-in-principle" reveals how norm implementation often deviates from original intentions, reflecting power struggles and competing interpretations. Jeffrey Checkel (2001) also offers important micro-foundations for understanding norm diffusion by providing nuanced insights into how norms are adopted, not through coercion, but through processes of repeated interaction, socialization, and persuasion. His distinction between "strategic calculation" and "social learning" helps clarify the varying motivations behind norm adoption: the former reflects instrumental behavior driven by cost-benefit analysis, while the latter indicates deeper internalization of norms through identity change and normative commitment.

Building on the debate between the "Second Image" and "Second Image Reversed" frameworks, we propose a more nuanced perspective: the state as a filter. Rather than viewing the state as either a passive recipient of international pressure or a fully autonomous actor, this framework suggests that states selectively mediate external norms and policies based on their political and economic interests. In doing so, states calculate their own levels of vulnerability and sensitivity to international pressures and adapt accordingly. This adaptive process exists along a spectrum, ranging from full adoption of global norms to partial adaptation, symbolic compliance, or even active resistance. The “state as a filter” model is particularly useful for analyzing cases where the state is neither highly vulnerable nor under intense external pressure. In such situations, domestic political, institutional, and cultural contexts become the key determinants of whether, and how, international norms are adopted or transformed. This framework thus emphasizes the selective agency of states and underscores the importance of internal dynamics in shaping responses to global norm diffusion. In the next sections, we explored the global diffusion of microfinance and dessus the adapting of microfinance in Cambodia and Indonesia.

4. The Global Diffusion of Microfinance

Microfinance is a norm and idea raised and praised by the Global South, the typical developing and underdeveloped countries, rather than the rich and “core” countries. Microfinance gained global prominence in the 1980s and 1990s through advocacy by international financial institutions. These institutions promoted microfinance as universally applicable, aligned with neoliberal economic reforms and structural adjustment policies, and embedded within aid conditionalities. Nobel Peace Prize recognition of Muhammad Yunus and Grameen Bank further solidified microfinance’s legitimacy.

Microfinance refers to financial services, such as credit, savings, insurance, and other products, offered in small amounts to individuals, households, and micro-enterprises that are typically excluded from formal banking systems. These marginalized groups, including self-employed individuals and small shopkeepers, often lack the collateral or financial documentation necessary to access conventional credit (Beck 2015: 3). The growing diversity of MFI models and their associated socio-economic impacts across countries reflect a broader set of political, economic, and institutional dynamics. Thus, research on microfinance must continue to grapple with how best to balance financial sustainability, social equity, and developmental impact in varying national contexts. Why is this the case? Poor people often do not qualify for commercial bank loans due to a lack of stable assets and income. Microfinance institutions (MFIs) specifically target these individuals, providing small loans that enable them to engage in business and agricultural activities, thereby promoting employment and increasing income, ultimately helping them escape poverty.

The origins of modern microfinance trace back to the 1970s, gaining global recognition in the 1980s through the work of the Bangladeshi economist Muhammad Yunus and the founding of the Grameen Bank in Bangladesh in 1982. The Grameen model was first piloted in 1976 when Yunus lent USD 27 to 42 women in the village of Jobra, enabling them to purchase raw materials for small businesses and repay the loans quickly (Shekhar 2024). Its innovation lay in providing collateral-free loans under a system of mutual accountability among borrowers, allowing poor communities excluded from traditional banking to access financial resources (Yunus 2007).

Yunus exemplified this concept by founding Grameen Bank and earned him the Nobel Peace Prize in 2006. He firmly believed that "the poor always repay their debts"

and that "given the opportunity, they will seize the chance to improve their circumstances"(Dowla and Barua 2006). Grameen Bank provides poor people with access to financial markets, breaking the cycle of extreme poverty. This expansion of financial services to previously neglected individuals and small enterprises has recently been referred to as financial inclusion.

While Grameen Bank popularized the concept, similar ideas had existed previously. For instance, the Cooperative Credit Societies Act enacted by Britain in 1904 facilitated the expansion of rural credit in British India. In Bangladesh itself, colonial-era rural credit systems such as the Comilla model preceded Grameen. After independence in 1971, the Bangladesh Rural Advancement Committee (BRAC) continued to promote rural financial initiatives. Latin America, too, witnessed parallel developments, such as ACCION in Venezuela and Prodem/BancoSol in Bolivia(Mader 2015). But the success of Grameen Bank, especially in empowering women through income-generating activities that helped establish microfinance as a transformative tool for poverty reduction and economic inclusion.

The rapid global spread of microfinance after the 1990s was significantly driven by the World Bank, which began endorsing microfinance as a central tool for poverty alleviation. In 1993, then-World Bank President Lewis T. Preston praised the success of microfinance programs in Bangladesh and Indonesia, highlighting their effectiveness in reaching grassroots populations, particularly women. His successor, James Wolfensohn, echoed similar sentiments(Weber 2004: 359-360). In 1995, the World Bank helped establish the Consultative Group to Assist the Poorest (CGAP). Though CGAP operated under the Vice Presidency for Financial and Private Sector Development, it functioned independently and was co-funded by ten major international aid agencies. Its mission was to expand access to quality microfinance services for the poor, improve both the quantity and sustainability of microfinance initiatives, and serve as a platform for knowledge exchange among development agencies and microfinance practitioners(CGAP 1999: 3; Bhatnagar et al. 2003: 1). CGAP aimed to mainstream microfinance within the broader development agenda.

According to CGAP, microfinance is a powerful tool in the fight against poverty because it delivers financial services, particularly credit and savings, to extremely poor households. These services enable economically active individuals to create, own, and accumulate assets, with proven effectiveness in grassroots contexts across developing

countries(Weber 2004: 360). During its first operational phase (1995-1998), CGAP focused on demonstrating the feasibility of microcredit. By its fifth phase (2013-2015), it began to incorporate the concepts of financial inclusion and inclusive finance, positioning microfinance as a key strategy within that broader framework (CGAP 2024). In doing so, CGAP embedded microfinance into the lexicon of international development aid and aligned it with prevailing neoliberal policy frameworks.

Since the 1990s, international development institutions like the World Bank have identified poverty reduction or eradication as one of the primary goals of official development assistance (ODA). This goal was later incorporated into the United Nations Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). The World Bank and its affiliate, the International Finance Corporation (IFC), regard microfinance as an effective tool for poverty alleviation and have actively promoted it.

With CGAP's advocacy, microfinance has evolved into a diverse set of financial services and institutional models. Many microfinance institutions (MFIs), once primarily nonprofit organizations, have increasingly adopted commercial practices or transformed into full-fledged commercial banks. While this shift has enabled broader outreach and scalability in promoting financial inclusion, it has also introduced new challenges. These include "mission drift": the shift from poverty reduction to profit maximization, and rising concerns over over-indebtedness and debt cycling (Armendáriz and Morduch 2010), as show in Cambodia

5. Cambodia: Donor-Driven Microfinance and Neoliberal Reform

Cambodia is a smaller and aid-dependent country, its modern institutions have been profoundly shaped by international intervention and assistance(Lin 2021). The 1991 Paris Peace Accords and United Nations Transitional Authority (UNTAC) essentially imposed a democratic framework, leading to Cambodia's first multi-party elections in 1993, a case of international norms of democracy triggering a new domestic political order. In the decades since, Cambodia has relied on foreign aid for over half its budget, giving donors significant leverage. Donor coalitions have repeatedly set governance benchmarks (anti-corruption laws, judicial reforms, human rights protections) as conditions for aid disbursement.

In Cambodia's case, heavy aid dependence created a situation where donor states could exert outsized influence on governance reforms (albeit with mixed success)(Lin 2021). A power-based lens thus scrutinizes whose interests are served by internationally driven reforms.

Cambodia's microfinance sector expanded rapidly post-1990s under extensive donor influence and market liberalization policies. Institutions such as ACLEDA Bank emerged from NGO origins, becoming significant commercial entities amid minimal regulatory oversight(Clark 2020). Rapid sector growth led to widespread financial access but also significant vulnerabilities, reflected in rising indebtedness, asset losses, and social instability. Critical studies from NGOs and international researchers document negative consequences, questioning the sector's sustainability and overall impact on poverty.

5.1 Early Microfinance-Like Systems in Cambodia (Pre-WWII)

Prior to World War II, Cambodia did not have formal "microfinance" institutions, but it did rely on traditional rural credit practices. Villagers often used informal rotating savings and credit associations, known locally as "tong tin", where groups pooled money and took turns receiving lump-sum payouts based on a competitive bidding process. Such ROSCAs provided a way to save and borrow in the community long before modern microfinance. However, many farmers still depended on moneylenders (often local Chinese merchants) who charged high interest rates. Colonial-era accounts criticized the "usury of Chinese rural merchants" and the severe shortage of affordable credit for Cambodian peasants(Slocumb 2010). In short, informal finance filled the gap in pre-war Cambodia, as neither the French colonial administration nor local authorities had established effective rural credit institutions for the poor.

5.2 Rural Credit from Post-WWII to Khmer Rouge Era (1950s~1975)

After independence in 1953, Cambodia's formal banking sector remained rudimentary and largely absent from rural life. In the 1950s and 1960s, commercial banks served primarily urban traders and elites, virtually no bank credit reached rural farmers. Prince Sihanouk's government did not institute a public agricultural bank or widespread cooperative credit system to serve peasants' needs. As a result, village households still relied on informal lenders, relatives, and "tong tine" for small loans. High-interest private lending persisted (much of it unregulated), continuing the pattern

from the colonial era (Slocumb 2010). Some plans for rural credit cooperatives were floated in the late 1960s, but these never materialized before the country was engulfed in war. During the Khmer Rouge regime (1975-1979), all financial institutions were abolished, money itself was outlawed, eliminating any vestiges of traditional credit. This period destroyed the nascent formal financial system, leaving a huge void in rural credit that would only begin to be filled years later in the post-war reconstruction.

5.3 Post-1979 Recovery and the Emergence of Microfinance

In the 1980s, Cambodia had to rebuild its economy and banking system from scratch after the devastation of the Khmer Rouge era. Formal banking was extremely limited and concentrated in cities, so rural communities once again depended on informal financing. People revived traditional practices like “Tong tin” and small-group lending among neighbors, as trust in institutions was low. It was not until the early 1990s, after the peace accords and UN intervention that modern microfinance began to take root. A wave of international NGOs and aid agencies arrived to help reconstruct Cambodia’s society and economy. Many introduced microcredit programs as a tool for livelihood recovery and poverty alleviation in rural areas

By the mid-1990s, Cambodia’s first microfinance projects were underway, often funded or implemented by organizations like USAID, the ILO, UNDP, World Vision, and Catholic Relief Services. These early programs provided small loans to farmers, traders, and returned refugees who had no access to banks. In the absence of any traditional banks or cooperatives serving poor villagers, microfinance institutions (MFIs) effectively stepped in to replace the old informal systems with slightly more organized credit. For example, the post-war proliferation of the tong tin (informal savings groups) demonstrated the demand for small credit, and MFIs offered a safer, more reliable alternative to these informal circles. Throughout the 1990s, Cambodia’s microfinance sector grew from these NGO-driven initiatives, gradually transitioning from relief-oriented microcredit to a nascent financial industry.

5.4 Development and Commercialization of MFIs (1990s-2000s)

By the late 1990s and 2000s, Cambodia’s microfinance sector began a significant transformation. Many NGO microcredit programs evolved into formal MFIs, obtaining licenses and professionalizing their operations. In fact, virtually all of today’s major Cambodian MFIs trace their roots to NGOs or humanitarian projects after 1991. As

peace and stability returned, the Cambodian government and donors encouraged this evolution. In the mid-1990s, the Asian Development Bank and other donors worked with the government to establish a basic regulatory framework that would formalize and commercialize microfinance institutions. A 1999 Law on Banking and Financial Institutions set the legal foundation for licensing MFIs under the National Bank of Cambodia (NBC). Early 2000s reforms enabled qualified microcredit operators to incorporate as private companies and eventually take deposits. For example, ACLEDA, originally an NGO project, was transformed first into a specialized bank and later a full commercial bank by 2003, providing a model for others. Crucially, the government embraced commercialization as a strategy to expand microfinance. Authorities believed that attracting private capital and running MFIs on business principles would ensure the sector's sustainability and outreach.

By allowing NGO lenders to become for-profit institutions (often with foreign investors), Cambodia rapidly built one of the most dynamic microfinance industries in the region. Between 2001 and 2010, the sector showed “dynamism, with good results” in terms of growth and outreach. MFIs spread into nearly all provinces, filling the gap left by absent rural banks. The common trajectory was that donor-funded MFIs grew and then sought commercial funding to scale up. By the late 2000s, many had attracted equity investments and were operating sustainably. This commercial turn allowed MFIs to offer new services (like voluntary savings, introduced after 2007) and to compete on efficiency. Industry advocates argued that a “private sector approach”, supported as needed by donors, would integrate microfinance into Cambodia's broader financial system and drive rapid expansion.

However, commercialization also meant higher profit motives. Interest rates on micro-loans in Cambodia remained relatively high (often in the 2~3% per month range in the 2000s), and MFIs increasingly focused on growth and profitability. Still, through the 2000s the prevailing view (shared by the government and donors) was that letting the market drive microfinance would maximize outreach. Indeed, Cambodia became a showcase: by 2010 its microcredit penetration was among the highest globally, and major MFIs were posting healthy profits. One analysis notes that by the early 2010s Cambodia had one of the world's largest and most profitable microfinance sectors as a result of these commercializing reforms. In short, the 1990s-2000s saw microfinance evolve from charitable relief to a full-fledged industry, integrated with international

capital markets. Local MFIs morphed into robust institutions, but this came with new regulatory challenges for the government as discussed below.

5.5 Government Regulation Before 2010

In the 1990s and 2000s, the Cambodian government's regulatory approach to microfinance was relatively light-handed and enabling. The NBC (central bank) put in place basic prudential rules for MFIs (licensing, minimum capital, reporting requirements), but generally prioritized expansion over heavy regulation. Therefore, the Government's regulation toward MFIs is "Light-Touch" Oversight and Growth Orientation. Several key features characterized the pre-2010 approach:

5.5.1 Market-Based Interest Rates

The government adopted a market-oriented interest rate policy, explicitly deciding not to cap microloan interest rates. The policymakers argued that most MFI funding came from private sources, and an interest cap would "discourage growth" by making microfinance unprofitable. They believed competition among the growing number of MFIs would naturally drive interest rates down over time. Thus, before 2010 there were no legal limits on the rates MFIs could charge, and annualized rates of 30%+ were common. This laissez-faire stance was intended to attract investors and allow lenders to cover high operational costs in rural areas.

5.5.2 Facilitating NGO Transformations:

The government made it administratively easy for NGOs to transform into licensed MFIs or banks. A simple set of conditions was established to grant an MFI license (under the 2000 Prakas on microfinance), and authorities actively promoted the conversion of NGOs into regulated MFIs. No state-owned retail microcredit provider was created; instead the private microfinance sector was seen as the engine for rural credit. The state's role was mainly to register, license, and supervise these new microfinance companies. By 2010, over 20 MFIs had been licensed by NBC, alongside dozens of smaller registered credit operators.

5.5.3 Limited State Intervention in Lending:

The Cambodian government deliberately kept direct state involvement minimal. Policy statements noted that the government "is not directly involved in microfinance operations or lending", leaving credit decisions to the MFIs themselves. Unlike some countries, Cambodia did not establish a large state microfinance bank for retail lending,

the state-owned Rural Development Bank functioned only as a wholesaler to MFIs. This hands-off approach extended to debt collection, local authorities were generally not supposed to interfere or assist in MFI loan recovery, though in practice, this boundary was sometimes blurred before 2010.

5.5.4 Encouraging Competition and Outreach:

Regulators encouraged MFIs to open branches in remote areas and expand outreach, even allowing some regulatory forbearance to spur growth. The idea was that more competition would both widen access and eventually put downward pressure on interest rates. By 2010, microfinance coverage had grown to millions of clients, dramatically increasing rural access to credit. In parallel, Cambodia in 2006~2010 built supportive infrastructure (roads, telecommunications) which helped MFIs lower their operating costs and interest rates for borrowers.

During this period, consumer protection rules were nascent. The focus was on building the industry, so few specific regulations targeted issues like transparency or over-indebtedness. There was no formal interest disclosure standard until later, and aggressive lending or collection practices received little oversight from NBC in the 2000s. Nevertheless, by the end of the decade, signs of risk were emerging, multiple borrowing by clients and fast loan portfolio growth raised concern that some households were becoming over-indebted. In response, the NBC and industry took a preliminary step by establishing the Credit Bureau Cambodia in 2012 (with a prakas passed in 2011) to improve credit information sharing. The credit bureau allowed lenders to check clients' existing debts, aiming to curb unchecked multiple loans. This was one of the first concrete measures to address over-indebtedness, though it came just after 2010. Overall, pre-2010 regulation succeeded in creating a booming microfinance sector under a laissez-faire, commercial model, but at the expense of accumulating systemic risks which would become more evident in the next decade.

5.6 Post-2010 Regulatory Reforms

Around 2010 and in the years following, Cambodia's microfinance industry entered a new phase, one of massive scale-up and mounting concerns. After 2010, thanks to years of commercialization, the sector experienced "explosive growth", becoming one of the world's largest microcredit markets in per capita terms. Total micro-loan outstanding amounts grew exponentially, and many MFIs enjoyed record

profits. However, this rapid expansion also led to serious problems: by the mid-2010s, independent observers warned of widespread over-indebtedness among low-income borrowers and predatory practices by some lenders. Households were found to be taking multiple loans and leveraging land titles as collateral, and signs of distress, such as forced land sales and debt-driven migration, began to surface (Bylander et al. 2019). In 2016, analysts flagged that Cambodia's average microloan size had become the largest in the world relative to GDP, and debt per borrower was unsustainably high (Green and Bylander 2021).

These red flags prompted the government and central bank to shift from a purely hands-off stance to a more interventionist regulatory approach after 2010 to tackling over-indebtedness and consumer risks. The key regulatory measures and policy responses in the post-2010 period includes interest rate cap, stronger prudential requirements, and consumer protection and lending guidelines

In March 2017, the National Bank of Cambodia abruptly introduced an interest rate ceiling of 18% per annum on all microfinance loans. This was a striking policy reversal, given that for years authorities had opposed caps. The cap was ostensibly aimed at reducing the debt repayment burden on borrowers and curbing usurious rates. In practice, it immediately slashed the typical interest rate (many MFIs had been charging 25-30%+ annually). While the cap was popular politically, critics noted it could cause smaller MFIs to struggle (since lending to remote clients at 18% might barely cover costs). Some MFIs responded by adding fees or lowering loan sizes. Nonetheless, the interest cap signaled the government's recognition that high interest rates were a problem and a willingness to sacrifice the pure free-market approach to protect consumers.

In the regard of paying stronger regulation, in late 2016, as the credit boom peaked, the NBC raised capital reserve and liquidity requirements for microfinance institutions. Also, licensed MFIs were required to hold higher paid-up capital (for instance, deposit-taking MFIs saw minimum capital raised substantially). This policy aimed to rein in the explosive growth by ensuring only well-capitalized, stable institutions could operate. Tighter capital rules forced some smaller or marginal MFIs to merge or exit, thereby slowing the pace of credit expansion. It was effectively an attempt to cool down what many feared was a bubble of easy credit fueling over-indebtedness.

In the mid-2010s, the microfinance industry, in cooperation with regulators and investors, developed a greater focus on responsible lending standards. The Cambodian Microfinance Association (CMA), founded in 2004, worked with international supporters to implement a sector-wide Code of Conduct and Responsible Lending Guidelines for all member MFIs. By 2017, these guidelines prohibited unethical lending (such as taking a client's land title without proper process) and encouraged thorough debt affordability analysis before loan approval. Several leading MFIs also pursued independent Client Protection Certification, as of 2019, seven Cambodian MFIs had attained Gold-level certification by meeting standards on transparent pricing, fair treatment, and prevention of over-indebtedness.

While these measures were largely voluntary, the NBC endorsed them and began monitoring compliance through its supervisory process. The NBC launched the Credit Bureau (CBC) in 2012, became a central tool for controlling over-indebtedness. All licensed lenders are required to check the credit history of applicants. The CBC developed a monthly debt report dashboard that flags borrowers who are refinancing loans repeatedly or taking on multiple debts. The NBC officials can use this data to identify and sanction MFIs engaging in aggressive refinancing or overlending to already-indebted clients. This has helped somewhat to curb reckless lending, though enforcement is an ongoing challenge.

The Cambodian government also took the somewhat unusual step of clarifying that microfinance is a private, commercial activity, not a government social program. In 2017, Prime Minister Hun Sen launched a campaign ordering all media and even mobile phone operators to spread the message that “all microfinance institutions in Cambodia are private, not state-owned (Turton 2020). This was done because many rural borrowers believed their micro loans came from the government (or would be forgiven by politicians). The Prime Minister explicitly stated that defaults would have consequences and not be bailed out by the state. Hun Sen also instructed local authorities and police to stop accompanying MFI agents to collect debts (to prevent any impression of official coercion). These steps were meant to bolster consumer understanding and prevent political exploitation of the debt issue. They underscored that microfinance had fully transitioned to a commercial banking business, a stark contrast to its NGO origins.

However, effectiveness of these regulatory measures has been mixed. On one hand, the post-2010 interventions did address some excesses of commercialization. The 18% interest cap lowered interest costs for many borrowers and competition plus the cap have brought average rates down. The credit bureau and lending guidelines have likely averted some instances of debt-piling by forcing lenders to be more cautious. For example, responsible lending practices (encouraged by major investors) now require MFIs to assess a household's total debt service ability, a practice that was weak in earlier years. There is also somewhat greater consumer awareness of rights; borrowers can, in theory, complain to the NBC or authorities if faced with harassment (CENTRAL and LICADHO 2020).

On the other hand, critics argue that over-indebtedness remains a serious problem in Cambodia despite these actions. Studies in recent years found that the country's microloan debt per capita is the highest in the world, and many rural families have had to reduce consumption or sell land to meet payments. A long-predicted microfinance crisis began to materialize around 2016, when delinquency rose and reports of distress multiplied, essentially confirming that regulation had lagged behind the aggressive growth. The government's measures were largely "belated emergency" responses. For instance, the interest rate cap, while easing the burden on borrowers, came only after a debt bubble had formed, and some analysts worry it doesn't address the root cause (which is borrowers taking loans beyond their means). Similarly, raising capital requirements reduced the number of lenders but did not directly help indebted clients already in trouble. Consumer protection enforcement is still evolving; rural borrowers often have limited financial literacy and bargaining power. There have been continued reports (from NGOs like LICADHO and others) of coercive collection practices and borrowers feeling compelled to migrate or sell assets to repay loans, indicating gaps in protection (EC and LICADHO 2021).

In summary, the Cambodian government's regulatory approach post-2010 shows a clear shift from a pro-growth, laissez-faire stance to a more cautious, interventionist posture as the sector matured. Before 2010, regulation was minimal and focused on enabling MFIs to commercialize and expand, with faith in market forces to balance outreach and costs (apraca.org)

After 2010, confronted with the downsides of an unrestrained microfinance boom, over-indebted households, high interest rates, and weak consumer awareness, the

government and NBC started to impose checks: capping rates, tightening supervision, and promoting responsible lending practices. These efforts have moderated some extremes of commercialization, but challenges persist. Cambodia's experience shows that building a microfinance sector quickly via commercialization can bring many people access to credit, yet strong regulation and consumer safeguards are crucial to prevent that access from turning into widespread debt distress. The ongoing task for regulators is to find the right balance between a thriving microfinance industry and the protection of the vulnerable clients it serves, a lesson that has become especially apparent in Cambodia's post-2010 microfinance journey.

6. Indonesia: State-Led Microfinance as Strategic Policy

After the Asian financial crisis, international pressure via IMF and World Bank conditions interacted with domestic political agendas and institutional capacities. The Indonesian government selectively implemented neoliberal reforms to stabilize the economy and regain legitimacy while maintaining strategic oversight to ensure rural economic stability and poverty alleviation goals(washingtonpost.com). These externally mandated policies accelerated Indonesia's domestic economic transformation (and arguably contributed to Suharto's fall and the subsequent democratization). In the 2000s, Indonesia's reforms continued under combined international and domestic influences: joining the WTO and ASEAN free trade schemes pushed trade and investment policy changes, while global norms of democracy and human rights encouraged Indonesia's transition to electoral democracy and the establishment of institutions like a national human rights commission. Indonesia's adoption of an Anti-Corruption Commission (KPK) and other governance reforms also reflected international anti-corruption norms championed by the World Bank and NGOs.

Indonesia's microfinance policies evolved through deliberate state intervention since the 1970s. Key initiatives include Bank Rakyat Indonesia's (BRI) rural banking network and the Kredit Usaha Rakyat (KUR) program, targeting micro-entrepreneurs. The government strategically liberalized the financial sector to enhance rural financial inclusion while ensuring regulatory frameworks to maintain stability and mitigate risks. Empirical studies demonstrate modest but measurable reductions in rural poverty, indicating effective regulation and targeted policies. The evolution of microfinance

institutions (MFIs) and government regulation toward microfinance in Indonesia reflects a dynamic interplay between domestic policy agendas, international influences, and evolving institutional capacities.

6.1 Informal Finance in the Pre-Colonial era

In Indonesia, informal community-based finance has deep historical roots. Long before formal banking, villagers relied on mutual aid and rotating savings and credit circles to meet financial needs. A prominent traditional practice is the *arisan*, a type of rotating savings and credit association (ROSCA) where members contribute regular payments to a fund that is given to each member in turn. Anthropologist Clifford Geertz(1962) observed in the 1960s that such *arisan* groups function as an "intermediate institution" bridging subsistence agrarian life with the monetized economy. These ROSCAs operate on trust, social capital, and peer pressure in lieu of formal contracts, demonstrating the cultural norm of gotong royong (mutual cooperation) in financial matters. Alongside ROSCAs, other informal mechanisms have included family networks, moneylenders, and pawnshops to provide credit in times of need. These indigenous systems laid the groundwork for financial inclusion by pooling community resources and enforcing discipline through social ties, thereby embodying a proto-microfinance role in traditional society. Such practices illustrate that the concept of microfinance, providing small, accessible loans and savings facilities, is not new to Indonesia, but rather is built upon longstanding communal traditions.

6.2 Microfinance in the Colonial Era, 19th C. -1945

Under Dutch colonial rule (19th to mid-20th century), more formalized microfinance institutions began to emerge, often initiated by the colonial administration. The Dutch introduced rural credit programs to curb usurious village moneylenders and stabilize the rural economy. Early efforts were inspired by the European cooperative movement (Raiffeisen model), aiming to create village banks and credit co-operatives for the indigenous population. In 1895, a local regent in Purwokerto, Central Java, founded the Poerwokertosche Hulp-en Spaarbank (Purwokerto Help and Savings Bank) to serve Indonesian civil servants, a modest institution that would eventually evolve into Bank Rakyat Indonesia (BRI)(Prawiranata 2013). By the 1930s, the Dutch had consolidated many of these experiments into a more centralized structure. After a period of rapid expansion (over 12,000 village units at one

point) followed by many failures once they charged cost-covering interest rates, the surviving rural banks were restructured under regional control. Around 1934, approximately 90 district-level People's Credit Banks (bank rakyat or afdeelingsbank) were merged to form the Algemeene Volkscredietbank (AVB, General People's Credit Bank) (Prawiranata 2013).

The colonial banking system introduced formal credit mechanisms to rural areas, though these were primarily designed to serve colonial economic interests rather than indigenous development needs. Nonetheless, by the end of the colonial era, Indonesia possessed one of the world's largest rural micro-banking systems and established the institutional framework and regulatory precedents that would later be adapted for independent Indonesia's microfinance sector.

6.3 Post-Independence Microfinance 1945-1980s

Following independence in 1945, Indonesia inherited the colonial microfinance infrastructure and began molding it to national needs. The AVB was promptly nationalized and, in 1946, re-established by the new government as Bank Rakyat Indonesia (BRI), literally "People's Bank of Indonesia". BRI became Indonesia's first state-owned bank and absorbed the assets of the former AVB by 1950, uniting the colonial credit cooperatives into a single institution.

From the 1950s to 1970s, Indonesia's microfinance strategy heavily involved subsidized credit programs to accelerate rural development. State-directed schemes like Bimas (Bimbingan Massal, a mass guidance program for rice intensification) used BRI as the main conduit for cheap credit to small farmers. BRI's Unit Desa (village unit) network was expanded during the late 1960s to deliver Bimas loans nationwide. While these programs initially boosted rice production, they suffered from loan defaults and fiscal burdens due to below-market interest rates and political interference (SMERU Research Institute 2006).

By the early 1980s, a paradigm shift occurred as the government moved away from subsidy-dependent credit toward a sustainable microfinance model. In 1983 interest rate controls were lifted, and BRI was authorized to commercialize its micro-banking operations. BRI's village units were then overhauled to operate on a commercial basis, leading to the launch of Kredit Umum Pedesaan (KUPeDES, or "General Rural Credit") in 1984 as an unsubsidized microloan program. KUPeDES offered small loans at market interest rates to rural entrepreneurs and farmers for any

productive purpose, coupled with a parallel voluntary savings product called Simpanan Pedesaan (SIMPEDES) for rural depositors(Charitonenko et al. 2004: 14). This innovation proved transformative: freed from subsidy constraints, BRI's microfinance unit network achieved high repayment rates and became profitable, demonstrating that serving low-income clients could be financially sustainable (Robinson, 2002). By 1989, KUPEDES had even expanded into urban areas (becoming known as general-purpose "Kupedes" credit) and the BRI Unit Desa system was heralded as a model of successful rural microfinance. (Rosengard 2022)

The post-independence evolution thus saw BRI emerge as the flagship microfinance institution in Indonesia, blending its cooperative roots with modern banking practices. By the 1990s, BRI's microbanking system had grown into one of the largest in the world, with millions of small borrowers and savers, and a reputation for self-reliability(Charitonenko et al. 2004). Alongside BRI, a diverse microfinance sector flourished: state pawnshops (PT Pegadaian) expanded pawn credit services, credit unions and cooperatives provided community-based loans, and private rural banks (Bank Perkreditan Rakyat, BPR) began to operate in towns and villages. This pluralistic growth underscored the importance of microfinance for Indonesia's rural economic development and financial inclusion goals, setting the stage for a needed regulatory framework to oversee the myriad institutions involved.

6.4 Evolution of Government Regulation and Oversight, 1990s-2020s

As Indonesia's microfinance sector grew in scope and variety, the government gradually developed a regulatory framework to ensure its soundness and reach. For many years, microfinance operated in a semi-formal "grey area," split among banks, cooperatives, and informal providers with inconsistent oversight. A major turning point was the Banking Act of 1992 (Law No. 7/1992), which reorganized the banking system into a two-tier structure. This law officially recognized small rural banks, known as People's Credit Banks (Bank Perkreditan Rakyat, BPR), as a distinct category alongside commercial banks(Charitonenko and Afwan 2003: 7). BPRs are locally operating banks permitted to collect deposits and lend on a smaller scale, created to bring informal village lenders into the regulated system. Bank Indonesia (the central bank) was tasked with licensing and supervising BPRs, imposing prudential standards to professionalize what were often family-run or community banks. The 1992 law, amended in 1998, enabled hundreds of BPRs to be established across the country, thereby integrating

microfinance into the formal financial sector. In parallel, the government encouraged cooperatives to offer savings and loan services under the Cooperative Law (No. 25/1992), albeit under the purview of the Ministry of Cooperatives rather than the central bank. During the 1990s, therefore, regulation was fragmented: Bank Indonesia regulated microfinance when delivered by banks (including BPRs and BRI), while thousands of savings and credit cooperatives and various NGO-run microcredit schemes remained largely unregulated or supervised by local authorities.

By the 2000s, policymakers recognized the need for a more unified and comprehensive oversight of microfinance institutions (MFIs). Studies highlighted legal ambiguities. For example, many microfinance providers lacked clear legal status or the authority to mobilize public deposits. This “regulatory black hole” meant that client protection and institutional health in the microfinance sector could not be assured uniformly. In response, Indonesia undertook financial regulatory reforms. In 2011, the government established the Otoritas Jasa Keuangan (OJK, Financial Services Authority) under Law No. 21/2011, an independent agency to take over financial supervision from Bank Indonesia and other bodies. OJK’s mandate covers all financial services, including banks, insurance, capital markets, and non-bank finance companies. Crucially, it was also tasked with overseeing microfinance institutions that were previously unsupervised. To cement this, the landmark Microfinance Institutions Law (Law No. 1 of 2013) was enacted on January 8, 2013, providing a dedicated legal framework for MFIs. This law for the first time defined what constitutes a microfinance institution, permitted only two legal forms (a cooperative or a limited-liability company/PT), and set operational scope and licensing requirements. This law came fully into effect in 2015 that explicitly requires all non-bank MFIs to obtain a license from OJK and subjects them to OJK regulation and supervision, with a two-year transition period (Kusuma 2022: 81).

Under the new framework, OJK holds broad powers to supervise MFIs, including authority to approve MFI mergers, consolidations or liquidations, and to enforce geographic and business limitations (e.g. MFIs can only operate in specified local areas and cannot take demand deposits) This regulatory evolution has significantly strengthened the governance of microfinance in Indonesia. Bank Indonesia played an early role by creating the BPR system and mandating bank credit quotas for micro and

small enterprises, but it is now focused on monetary policy and financial inclusion strategy, while OJK serves as the integrated supervisory agency.

Indonesia's microfinance landscape is overseen through multiple layers: commercial banks like BRI are regulated as banks by OJK, BPRs are subject to specialized bank regulations, and cooperatives or microfinance NGOs have either transformed into licensed MFIs or operate under cooperative laws with OJK oversight as mandated by the 2013 MFI Law. The government has also instituted national strategies for financial inclusion, and agencies like OJK and Bank Indonesia coordinate on programs such as Laku Pandai (branchless banking) to expand access to financial services (IMF 2024: 39).

In sum, over the past three decades Indonesia has moved from an ad-hoc, fragmented approach to a coherent regulatory regime that supports microfinance development while protecting borrowers and depositors. This enables the rich legacy of Indonesian microfinance, from village *arisan* groups to BRI's microbanking empire, to continue evolving under prudent oversight, furthering the country's goals of rural development and broad-based financial inclusion.

7. Comparative Analysis: Indonesia vs. Cambodia

The trajectories of microfinance in Indonesia and Cambodia reveal a stark contrast between a balanced, state-supported model and a donor-driven, market-led model. Indonesia leveraged international support within strong domestic institutions to align microfinance with national development goals, a strategy that yielded broad-based financial inclusion and poverty reduction. In Cambodia, heavy reliance on foreign aid meant that microfinance policies were largely shaped by donor conditionalities. Weak domestic regulatory capacity allowed commercial imperatives to dominate, leading to rapid growth but also widespread vulnerabilities such as over-indebtedness.

This section examines the international and domestic factors behind these outcomes, compares the two regulatory approaches, and discusses key challenges and lessons. The diffusion of microfinance in both countries was significantly driven by international financial institutions (IFIs), donor agencies, and global norms that promoted financial inclusion under neoliberal market principles. Global policy pressures through mechanisms like IMF programs and donor aid conditions set the initial stage for microfinance reforms in many developing countries. However, the

Table 1 indicated Cambodia and Indonesia adapted differently to these external influences

Table 1 Adaptation of Microfinance in Cambodia and Indonesia

Category	Cambodia	Indonesia
International Influence	Higher donor dependency from early 1990s. Donor-driven reforms	Stronger influence from World Bank, IMF, ADB post-1997 crisis. Selectively adapted global norms
Domestic Institutional Capacity	Lower. Weak state institutions and heavy external guidance	Higher. Strong institutions like Bank Indonesia and OJK
Regulatory Oversight	Weaker Minimal oversight, donor-driven frameworks	Stronger. Balance of market liberalization and supervision
Microfinance Policy Model	Liberal. Rapid commercialization and minimal regulation	Balanced. Market-oriented with targeted state interventions

Source: the author.

7.1 Global Influence on Microfinance Policies

In Cambodia, foreign donors and international NGOs essentially jump-started the microfinance industry in the 1990s. Agencies including the World Bank, IMF, UNDP, and bilateral donors heavily influenced Cambodia's early microfinance policies. Aid conditionalities shaped regulatory decisions. For example, encouraging an open market and the transformation of NGO credit programs into licensed microfinance institutions (MFIs). As a result, Cambodia's microfinance landscape was predominantly donor-driven from the outset, with its legal and institutional structures molded to fit global models and donor expectations. In Indonesia, Multilateral institutions such as the World Bank, IMF, and Asian Development Bank (ADB) played pivotal roles in financial sector reforms, especially in the aftermath of the 1997 Asian financial crisis. International bailouts and aid came with conditions that pushed Indonesia towards market liberalization and the creation of regulatory frameworks supportive of rural finance and microcredit. These reforms were embraced and implemented through

Indonesian institutions, laying groundwork for a more liberal yet supervised microfinance sector.

International factors provided the initial impetus for microfinance adoption in both nations. Global norms, such as seeing microfinance as a tool for poverty alleviation and financial inclusion, and the agendas of IFIs created pressure for domestic change. Understanding these influences is crucial to explain when and how Indonesia and Cambodia embraced microfinance. Yet, as the next shows, the ultimate trajectory of microfinance depended greatly on domestic conditions that filtered and modified these global ideas.

7.2 State Capacity and Institutional Context

While external influences set the stage, domestic political and institutional contexts determined the outcomes of microfinance policy in each country. The strength of state institutions, regulatory oversight, and alignment with local needs shaped whether international ideas translated into sustainable practices.

Indonesia's relatively robust state capacity meant that authorities could selectively adopt global microfinance norms and enforce them effectively. Institutions like Bank Indonesia (the central bank) and the OJK, provided strong regulatory oversight over microfinance activities. The government strategically aligned microfinance with national development policies – for instance, using microcredit to promote rural development and stability. This alignment created a balanced policy framework that harnessed market principles such as encouraging bank and MFI competition while mitigating negative externalities such as over-indebtedness. In practice, Indonesia combined targeted state interventions (like interest rate ceilings or subsidized programs for the poor) with commercial microbanking. This balance helped integrate microfinance into the broader financial system without sacrificing consumer protection.

Cambodia, by contrast, had limited state regulatory capacity and remained highly dependent on external guidance. Lacking a strong independent regulator in the early years, Cambodian authorities largely adopted a *laissez-faire*, market-oriented approach to microfinance under donor advice. The nascent regulatory framework that the 2000s laws under the National Bank of Cambodia focused on enabling rapid growth of MFIs, often with substantial foreign investment. However, domestic oversight was weak and there was no equivalent to Indonesia's OJK rigorously supervising microfinance, and consumer protection measures were minimal (Bateman 2020). As a result, the sector

saw explosive expansion of credit access without adequate checks. This environment, driven by commercial interests, led to socio-economic vulnerabilities: by the 2010s Cambodia faced widespread over-indebtedness and rural distress linked to microloan burdens. Essentially, the Cambodian government's hands-off stance which itself partly a product of limited capacity and the neoliberal policy advice from donors allowed market forces free rein, to detrimental effect.

These domestic differences were pivotal. Indonesia's strong institutions acted as gatekeepers, adapting international ideas on microfinance to local realities and ensuring they complemented national goals. Cambodia's weak institutions, on the other hand, meant global ideas so letting rapid microfinance expansion were imported with little modification or control. This contrast underscores a key lesson of political economy: external norms and models will produce divergent outcomes depending on how they are filtered through domestic structures.

7.3 Divergent Institutional Approaches and Outcomes

When comparing Indonesia's balanced regulatory approach with Cambodia's liberal, donor-dependent model, critical institutional differences emerge. These differences largely explain why microfinance contributed to sustainable poverty alleviation in Indonesia but led to instability in Cambodia. Several specific aspects highlight how Indonesia's regulatory evolution differed from Cambodia's approach. The Table 2 indicated the diverse result of the adaptive microfinance in the two countries.

Table 2 Adaptive Outcomes of Microfinance in Cambodia and Indonesia

Category	Cambodia	Indonesia
Commercialization Outcome	Rapid growth but led to instability and mission drift	Managed commercialization with prudent controls
Consumer Protection	Reactive and delayed. Early years lacked safeguards	Proactive. Credit bureaus, lending standards, OJK enforcement
Impact on Poverty Alleviation	Mixed or limited. Overshadowed by commercial imperatives	Significant and sustainable poverty alleviation
Over-Indebtedness Risk	Higher. Widespread borrower distress and social issues	Moderate. Mitigated by oversight and institutional safeguards
Fintech and Innovation Management	Lagging. Limited regulation and oversight in fintech	Evolving. Regulators actively manage fintech risks

Source: the author.

The Indonesian model has been effective due to robust state institutions, strategic use of international support, and strong regulatory oversight, supplemented by targeted interventions. Indonesia accepted market-based microfinance but tempered it with prudent regulation and occasional subsidies, aiming for both outreach and borrower protection. This approach yielded more sustainable poverty alleviation outcomes, as seen in Indonesia's broad financial inclusion gains without a nationwide debt crisis. Indonesia's experience thus illustrates a balanced, state-regulated approach aligning neoliberal principles with national development goals achieving sustained poverty reduction and rural stability.

By contrast, Cambodia's microfinance model was market-oriented and externally driven, resulting in rapid but volatile growth. Heavily influenced by donor prescriptions, Cambodia prioritized liberalization and scale-up of microcredit over building domestic regulatory safeguards. This led to one of the world's highest microloan penetration rates, but also to substantial over-indebtedness among borrowers and questionable impact on long-term poverty alleviation. In essence, Cambodia became a cautionary example of how a purely market-led microfinance boom without

strong oversight or consumer protection can exacerbate financial vulnerabilities instead of reducing poverty.

7.3.1 Balanced Commercialization:

Indonesia combined market-based principles with targeted state interventions and robust regulations, preventing the excesses of commercialization. For example, Indonesian policymakers encouraged banks and MFIs to expand credit but also enforced prudent lending practices, helping to avert mass over-indebtedness. In Cambodia, by contrast, the rapid commercialization of microfinance occurred with minimal intervention, contributing to widespread debt problems as many borrowers took on multiple loans unchecked.

7.3.2 Institutional Capacity

Indonesia's stronger institutional capacity enabled it to implement global best practices effectively and adapt them to local conditions. Regulatory bodies in Indonesia could craft rules on capital adequacy, licensing, and supervision for MFIs and ensure compliance. Cambodia's weaker institutions struggled to do the same; even when laws existed on paper, enforcement was lax. As a result, some international standards (like credit information sharing or strict monitoring of lending practices) took much longer to materialize in Cambodia's sector.

7.3.3 Consumer Protection and Risk Management

Indonesia was proactive in establishing consumer protection measures early on. It created credit bureaus and promoted responsible lending standards (through OJK guidelines), which helped prevent large-scale debt crises. Cambodia lagged on these fronts. For many years, there was no nationwide credit bureau (Credit Bureau Cambodia was only established in 2012) and little oversight of how MFIs enforced collections. Unlike Cambodia, Indonesia's early attention to debtor protection and risk management meant that warning signs, such as too many overlapping loans) could be addressed before spiraling out of control.

These differences abovementioned illustrate why Indonesia and Cambodia experienced opposite outcomes from what was ostensibly the same development intervention. A well-regulated, institutionally supported microfinance system, like Indonesia, can integrate into the economy and aid poverty reduction, whereas a

liberalized, donor-driven system with weak governance, the Cambodia case, may achieve outreach at the expense of borrower welfare.

7.4 Current Challenges and Lessons

Despite its relative success, Indonesia's microfinance sector is not without challenges. As the industry evolves, regulators must remain vigilant on the risks of over-indebtedness and balancing innovation with stability. Even in Indonesia, there are persistent concerns about clients taking multiple loans from different providers. Lower-income borrowers remain vulnerable if lending standards slip. This underscores the ongoing need for strong oversight: credit checks, caps on total indebtedness, and financial literacy efforts, etc., to ensure microfinance does not inadvertently trap people in debt. In addition, the rise of fintech and digital lending in Indonesia presents a double-edged sword. On one hand, fintech can further expand financial inclusion; on the other, it introduces new risks. Regulators face the task of continually updating the framework to balance innovation and consumer protection. Ensuring that digital micro-loans remain affordable and transparent, and that fintech lenders are properly supervised, is essential to maintain the sector's stability.

For Cambodia, the current challenges are more acute and serve as a cautionary lesson. By the early 2020s, Cambodia's microfinance borrowers were the most heavily indebted in the world per capita, with reports of households selling land or forgoing basic needs to repay loans. International observers and even some investors have begun to recognize that Cambodia's model is unsustainable without reforms (such as tighter lending standards, interest rate caps, or debt relief programs). The lesson learned from Cambodia is that microfinance, if left unchecked, can exacerbate poverty, a stark reminder that the quality of growth matters more than the quantity of loans disbursed.

8. Concluding Remark

The international adoption of microfinance emerged from its promise as an innovative tool for poverty reduction, backed by global financial institutions such as the World Bank, IMF, and various UN agencies. However, empirical evidence has shown mixed results, often dependent on national contexts. This paper critically explores the differential adoption and outcomes of microfinance in Indonesia and Cambodia, employing an "State as a filter" framework to dissect the interplay between state capacity, market dynamics, and external influences.

Indonesia's microfinance trajectory demonstrates how a synergy of domestic institution-building and selective adoption of global ideas can yield inclusive and stable outcomes. Strong regulatory capacity, alignment with local development objectives, and proactive consumer protection allowed Indonesia to harness microfinance for poverty alleviation while keeping its risks manageable. In contrast, Cambodia's experience highlights the pitfalls of a hands-off, donor-led approach: rapid commercialization without sufficient safeguards led to unstable growth and social vulnerabilities.

Ultimately, the comparative analysis of Indonesia and Cambodia underscores that context matters. Microfinance's effectiveness as a development tool hinges on the institutional framework in which it is embedded. Well-regulated, state-supported frameworks as in Indonesia can integrate microfinance into a broader poverty reduction strategy. By comparison, minimally regulated models, exemplified by Cambodia, risk doing more harm than good, as unsustainable lending practices can entrench indebtedness and economic insecurity. Going forward, policymakers and development partners must prioritize building robust domestic institutions, enforcing prudent regulations, and tailoring microfinance initiatives to local socio-economic realities. Only with such context-sensitive and balanced approaches can microfinance live up to its promise of sustainable poverty alleviation.

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A Systematic Review of Knowledge Management Strategies for Organizational Performance

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Abstract

The strategic role of knowledge management (KM) in modern organizations has grown increasingly vital as firms adapt to rapidly changing environments and intensified global competition. As KM systems become embedded within organizational structures, understanding their influence on long-term performance, innovation, and adaptability is essential. Yet, the literature remains fragmented, often lacking clarity on how organizations manage different forms of knowledge and balance internal and external knowledge sources. To address this gap, this paper presents a systematic review of empirical research focused on the strategic integration of KM. Organized around three central questions and structured through a qualitative PRISMA methodology and thematic analysis, this review identifies four key themes: (1) market adaptability; (2) organizational success; (3) corporate integrity; and (4) enhanced service delivery. These themes illustrate how KM supports strategic alignment, improves decision-making, fosters innovation, and promotes value creation through people, processes, technology, and culture. In doing so, the paper offers a multidimensional framework for understanding KM's transformative potential. We conclude by outlining theoretical contributions, practical implications for leaders, and directions for future research to ensure that KM initiatives remain responsive, sustainable, and human-centred.

Keywords: knowledge management, artificial intelligence, PRISMA methodology, thematic analysis

1. Introduction

Organizations across the globe are navigating an increasingly knowledge-driven economy, where intellectual capital is emerging as a central force behind competitive advantage, innovation, and long-term viability. This shift, often described as the knowledge era, represents a fundamental transformation in how value is created, captured, and sustained in organizational contexts. As firms contend with volatile markets, rapid technological advancement, and evolving stakeholder expectations, the capacity to manage knowledge strategically has become a critical differentiator. Knowledge Management (KM)—the systematic process of acquiring, organizing, sharing, and leveraging knowledge—has thus evolved from a support function into a strategic imperative.

The importance of KM is underscored by the changing nature of organizational resources. Traditional factors such as capital and labor, while still relevant, are no longer sufficient on their own to sustain success in dynamic environments. Instead, knowledge—especially when managed effectively across both explicit (documented, structured) and tacit (experiential, intuitive) domains—enables organizations to remain agile, drive innovation, and respond to disruption with greater resilience. A growing body of literature supports this view, highlighting how organizations that embed KM into their strategic fabric outperform those that treat it as an ancillary function (Feng & Liu, 2024; Perifanis & Kitsios, 2023; Selçuk et al., 2025).

Despite the growing recognition of KM's value, its impact on long-term organizational growth remains insufficiently explored. Moreover, many studies have tended to treat explicit and tacit knowledge in isolation, overlooking how they are managed in tandem. Similarly, while the roles of internal knowledge sources (e.g., employee expertise) and external ones (e.g., customer insights) are acknowledged, there is a lack of clarity around how organizations balance these sources to inform strategy and execution. These gaps hinder the development of a unified understanding of KM's strategic role and the conditions under which it drives sustainable success.

This study aims to investigate these challenges by providing a systematic synthesis of the literature on KM, framed around the core questions: “What is the importance of knowledge management in this dynamic environment?”. It identifies the conditions under which KM practices contribute to market responsiveness, employee development, governance, and service excellence. Through a multidimensional

understanding of KM's strategic role, this study can contribute to a deeper appreciation of KM as a vital organizational capability. It offers practical insights for leaders seeking to integrate KM practices into their strategic agendas and highlights future research directions to advance both theoretical development and real-world application. In the sections that follow, we outline the study's methodological approach, present thematic findings, and discuss implications for practice, theory, and policy.

2. Methodology

A systematic review of literature PRISMA (Figure 1) was conducted through a structured search strategy. Initially, the search was executed on Google Scholar, with a cut-off date of February 25, 2024, and limited to peer-reviewed journals in English within the subject area of knowledge management. 80 articles were identified using targeted keywords such as "Knowledge Management," "Organisation Growth," "Customer Knowledge," and "Dynamic Environment," focusing on their impact on long-term organizational success. Of the 80 articles retrieved, 55 met the preliminary screening criteria based on journal quality, relevance to the research objective, and alignment with the study's thematic focus. These were further assessed for topic relevancy. Articles were excluded if they used AI as a primary analytical tool or were published before 2014, unclear address core themes such as "Dynamic Environment," "Tacit and Explicit Knowledge," or "Employee and Customer Knowledge," or not in English languages. Following these filters, 33 articles were finalized for in-depth analysis, all of which directly addressed the research questions. The results of the PRISMA process show a well-documented flow of information through these phases, highlighting how the selection narrowed from a broad set of initial records to a focused collection of studies that underpin the research findings. This rigorous methodology ensures that the conclusions drawn about the strategic integration of knowledge management are based on high-quality evidence and comprehensive analysis.

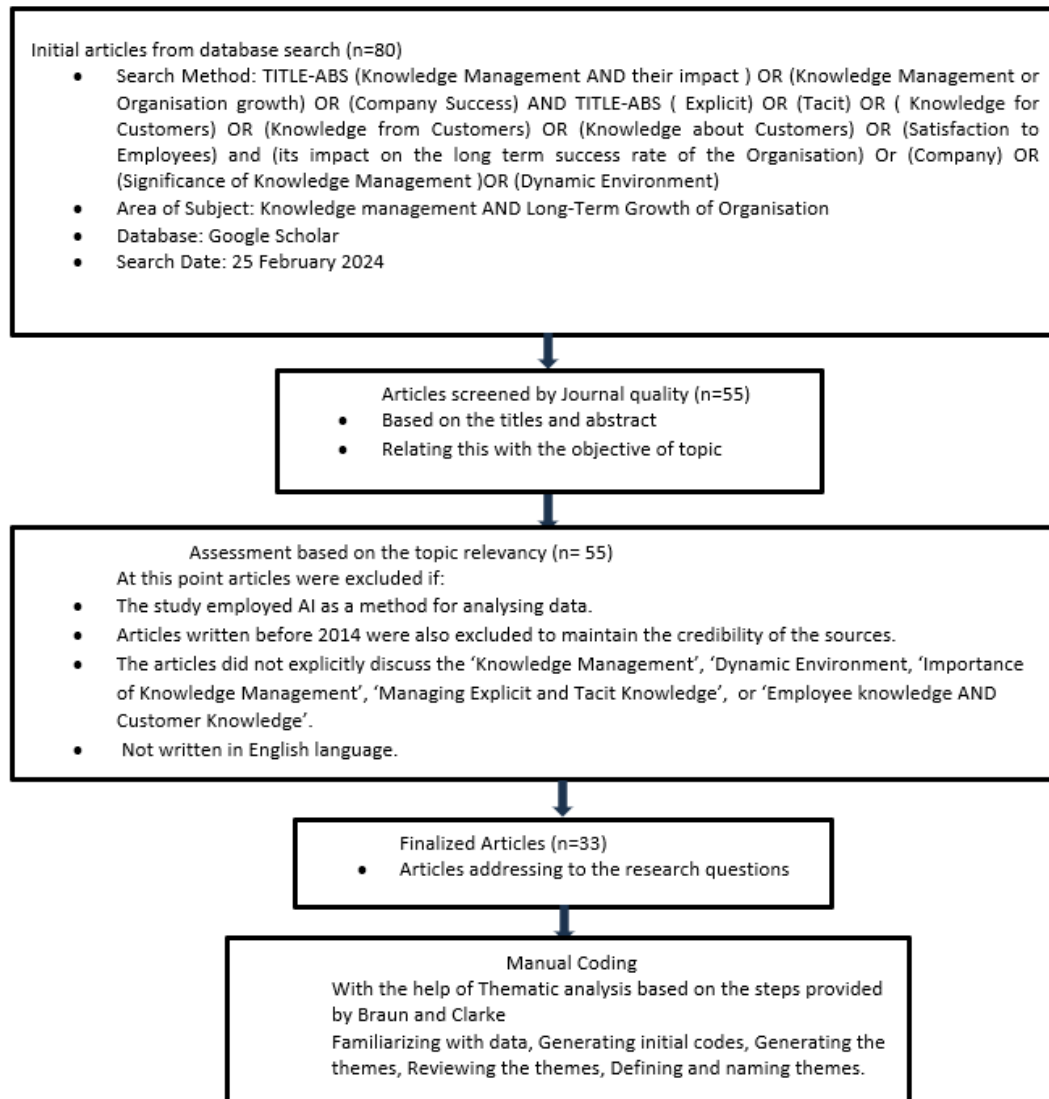


Figure 1: Flow diagram of search process

3. Coding procedures

Thematic analysis was used to interpret the qualitative data. Transcripts were coded using NVivo software, and recurring patterns and themes were identified. The analysis followed Braun and Clarke's (2006) six-phase approach: familiarization, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. The data analysis involved a systematic review of 33 peer-reviewed articles selected from an initial pool of 80, using strict inclusion criteria focused on relevance to knowledge management (KM) in dynamic environments. Articles using AI as the primary tool or lacking core KM themes were excluded. NVivo software was employed to code and analyze the data, following Braun and Clarke's six-phase thematic analysis approach. This process helped identify key patterns and

recurring themes related to tacit and explicit knowledge, as well as employee and customer knowledge, providing a strong evidence base for understanding the strategic role of KM in enhancing organizational performance. Overall, our sample is comprised of four themes. Figure 2. Thematic map illustrating four key themes derived from knowledge management analysis in dynamic environments: (1) Innovation as a strategic driver of competitive advantage, (2) Organisational success, (3) Corporate integrity, and (4) User-centric service excellence. Each theme is supported by relevant sub-themes reflecting the perceived importance of knowledge management.

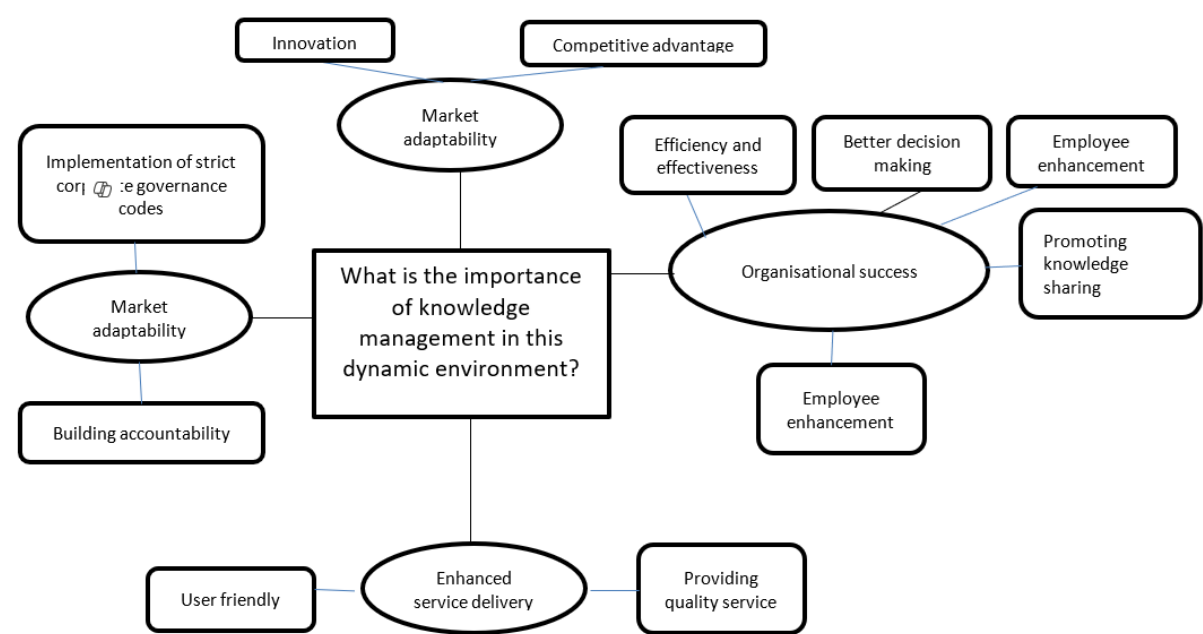


Figure 2: Themes identified based on the thematic analysis

4. Results

4.1 Theme 1 Market Adaptability

Market adaptability is increasingly recognized as a critical determinant of organizational resilience and success, especially in today’s fast-paced environments shaped by digital transformation and globalization (Goraya et al., 2024). It is closely linked with knowledge management (KM), which underpins agile and informed decision-making (Jayasundara et al., 2025). Through effective KM, organizations gain dynamic sensing capabilities, enabling real-time monitoring of market changes and translating insights into responsive strategies.

Knowledge-sharing systems such as real-time dashboards, collaborative platforms, and feedback loops empower firms to analyze massive data streams, leading to quicker iterations in product design, service offerings, and operations (Vashishth et al., 2024). Moreover, companies using AI-augmented KM tools have seen up to a 35 % productivity increase (Kumar, 2025). This empowers cross-functional teams with timely, actionable data to sharpen go-to-market strategies and anticipate customer needs—turning adaptability into a core competitive advantage (Hannila et al., 2025). Market adaptability entails proactive mechanisms (building foresight cultures and analytics) and reactive processes (tapping KM frameworks during disruptions) (Ahmad et al., 2024; Irfan et al., 2022). Collectively, these KM-driven capabilities allow firms to convert uncertainty into opportunity and secure sustainable advantage in turbulent markets.

Market adaptability is increasingly recognized as a critical determinant of organizational resilience and success, particularly in fast-changing environments marked by digital transformation, globalization, and evolving consumer demands. It is intricately connected with knowledge management (KM) as a foundational enabler of agile and informed decision-making (Abbas, 2024). Organizations that effectively leverage KM can develop dynamic sensing capabilities to monitor external environments, gather market intelligence, and translate those insights into responsive strategies. For instance, knowledge-sharing systems such as real-time dashboards, collaborative platforms, and feedback loops allow firms to collect and analyze vast data streams, facilitating swift adaptations in product design, service offerings, and operational processes (Vashishth et al., 2024).

KM empowers cross-functional teams with up-to-date, relevant information, enabling them to iterate solutions, refine go-to-market strategies, and anticipate consumer behavior more accurately (Alonge et al., 2025). This adaptability is not only a survival mechanism but a strategic differentiator, allowing organizations to stay ahead of competitors and meet stakeholder expectations. Furthermore, market adaptability involves both proactive and reactive mechanisms. Proactively, firms embed learning cultures and foresight analytics to pre-empt change; reactively, they utilize KM frameworks to mobilize internal knowledge assets in response to immediate disruptions. Thus, KM underpins an organization's capacity to transform uncertainty

into opportunity, thereby securing sustainable competitive advantage in turbulent markets.

4.2 Theme 2 Organizational Success

Organizational success in the contemporary knowledge economy is increasingly assessed through intangible assets, intellectual capital, and knowledge-driven capabilities. KM is a pivotal catalyst in achieving such multidimensional success spanning operational excellence, innovation, financial stability, and stakeholder trust (Jeremiah, 2023). KM is not treated as an isolated function but as an integrated strategic approach that permeates all facets of organizational performance (Zhang et al., 2024).

Effective KM enables faster and more accurate decision-making, streamlined workflows, and a collaborative work culture. It nurtures an ecosystem where information is continuously transformed into knowledge, and knowledge into innovation (Dameri & Demartini, 2020). This is achieved through practices such as knowledge repositories, communities of practice, after-action reviews, and performance analytics (Arumuru et al., 2024). Employees equipped with knowledge are more competent, engaged, and capable of contributing to complex problem-solving tasks that define high-performing organizations (Kossyva et al., 2024).

Moreover, the relationship between KM and organizational success is reinforced through alignment with long-term strategic goals. KM systems are designed to document and transfer critical knowledge, reduce redundancy, and minimize knowledge loss due to attrition or turnover (Iyiola, 2024).

4.3 Theme 3 Corporate Integrity

Corporate integrity beyond mere compliance is increasingly viewed as a dynamic outcome of structured KM practices. Well-designed KM frameworks instil transparency, accountability, and trust by embedding knowledge controls, audit trails, and ethical norms within workflows (Muller, 2025). Organizations with mature KM systems foster open cultures where data authenticity, intellectual property rights, and rigorous information governance are prioritized (Upadhyay & Patel, 2023). Ethical KM practices including ethics training, knowledge audits, and governance scaffolding reinforce this integrity by ensuring knowledge is neither misused nor siloed (Cortiñas-Lorenzo et al., 2024).

Furthermore, KM enhances corporate integrity by making operations transparent and traceable. Documented decision-making processes and feedback mechanisms

create auditability, reducing the risk of malpractice or manipulation and enhancing stakeholder confidence (Siong Choy, 2006). As can be seen that integrity is a core organizational competency, proactively institutionalized through KM systems.

4.4 Theme 4 Enhanced Service Delivery

Enhanced service delivery is a direct benefit of robust KM infrastructure. In service-oriented organizations, delivering value consistently hinges on the availability and accessibility of actionable knowledge (Twumasi Ankrah, 2025). KM equips service personnel with the right information at the right time, enabling them to meet customer expectations with precision and empathy. The role of KM in creating knowledge-rich interfaces for front-line employees, such as customer relationship management (CRM) systems, knowledge bases, and AI-enabled support tools, is increasingly prominent (Thanasas, 2024). These systems facilitate rapid issue resolution, personalization of services, and continuous improvement based on feedback. Employees are empowered to not only resolve problems but to anticipate customer needs and exceed expectations.

Furthermore, KM systems foster a culture of service excellence by capturing tacit knowledge from customer interactions and converting it into institutional knowledge (Ahmed, 2017). This feedback loop ensures that organizations evolve with their customer base, aligning service strategies with real-world demands (Ramirez, 2023). By linking operational efficiency with human insight, KM transforms transactional service into relational engagement, thereby enhancing customer satisfaction, loyalty, and brand reputation.

5. Conclusion

As organizations continue to operate in increasingly dynamic and knowledge-driven environments, the role of KM in shaping strategic outcomes has never been more critical. This study provides a comprehensive synthesis of the factors that contribute to successful KM integration highlighting its influence on market adaptability, organizational efficiency, innovation, and long-term competitiveness. By examining how firms manage both explicit and tacit knowledge, balance internal and external knowledge flows, and align KM strategies with business objectives, this research offers a foundational lens for understanding KM's transformative power.

Importantly, the findings underscore that KM is not merely a supportive function but a central mechanism for organizational resilience and growth. Success hinges on

the deliberate cultivation of knowledge-sharing cultures, effective leadership, and the thoughtful application of KM technologies and frameworks. For practitioners and scholars alike, these insights present a timely roadmap to navigate the complexities of knowledge-intensive work.

Looking ahead, it is imperative that organizations treat KM as a strategic priority one that empowers individuals, enhances service delivery, and drives sustainable innovation. Only through this lens can we unlock the full potential of knowledge as a catalyst for success in today's fast-paced, information-rich world.

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The Influence of Argument Strength and Valance on Online Incivility Adoption

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Abstract

Incivility behaviors and messages usually lead to more discussion in cyberspace, even make more eye-catching. According to the various types of message characteristic such as systematic information, e.g. argument content and heuristic information such as positive/negative framing, e.g. amount and number of followers etc. These cues would influence online users' information adoption. "Likes amount" concerned about how many people agree the main content, while "the number of followers" which shows that information source's popularity and credibility. Therefore, the two types of attributes would lead to different effects had to be discussed. The research purpose around how argument strength impacts information adoption. Subsequently the valance of information content would be added to construct experimented scenarios. Two-factors ANOVA was used, the research investigated 2 argument strength (strong/weak) x 2 comment feedback valance (more/less feedback) firstly and step 3 examined 2 argument strength (strong/weak) x 2 the ratio of followers and following's valance (positive/negative). The number of subjects were 62, 130 and 130 in each experiment, by using online community to send and collect questionnaires. Results showed that there is significant interaction between argument strength and "comment feedback valance" on information adoption, but followers' valance didn't show interaction with argument strength. In experiment 2, we verify that subjects used both heuristic and systematic process to decode the message. In experiment 3, compared with "comment feedback valance", the data indicated that "followers' valance" didn't relate to message content but source credibility, so subjects used systematic process upon information as main path to decode messages.

Keywords: Online incivility, Valance, Argument strength, Heuristic-Systematic model (HSM), Information adoption.

1. Introduction

1.1 Research background and motivation

Online information exchange is booming. People can see all kinds of information and types on the Internet. There are so many different things. How does the virtual world know whether the information is true or false? User comments will guide other message recipients to evaluate the article itself (Conlin and Roberts, 2016) and their understanding of social issues (Koltsova and Nagornyy, 2019). While reading the comments, the message recipients will also follow the comments. Different discussions lead to changes in personal views on the topic of the article (Duncan et al., 2020). It seems that "incivility" can be seen everywhere on the Internet. As previous research has pointed out, uncivilized behavior has become the norm in online news comments (Coe et al., 2014). Muddiman and Stroud (2017) proposed that online comments themselves have the role of stimulating audience participation; this means that the comments themselves are persuasive and can guide or influence the viewers of the message. What is the mechanism of influence? Accordingly, this study proposes

It needs to explore uncivil comments. Based on the views put forward by past research, this study will demonstrate that strength Manipulate it in the context of Internet incivility and consider different message processing cues for discussion. Chaiken (1980) proposed the Heuristics-Systematic Model (HSM), believing that people's judgment results will be affected by different ways of processing information. As an important factor for message readers to think about the persuasiveness of a message, more comment feedback may have a stronger impact on Strong arguments have the added effect of making readers evaluate reviews more convincingly (Hong and Cameron, 2018). In addition, positive comment feedback increases readers' recognition of uncivil comments (Sohn et al., 2019). When message recipients are exposed to uncivilized comments, faced with high- and low-intensity content, comment feedback, and the valence of followers, what impact does it have on message adoption? This is the main purpose of this study.

Research Objectives

Based on the above, the purpose of this study is covers three points below,

Understand consumers' intention to adopt messages if they watch uncivilized comments with high or low intensity. What kind of impact will it cause and what is the extent of the impact?

According to the HSM theory, understand the intensity of consumers' uncivilized comments when viewing arguments, What impact will the participation of "Review Feedback Valence" have on message adoption intention, and what is the extent of the impact?

Based on the HSM theory, understand the intensity of consumers' uncivilized comments when viewing arguments, What impact will the participation of JIS Clues' "Tracking Number of People Valence" have on message adoption intention, and What is the extent of the impact?

2. Literature Review

2.1 Heuristics-Systematic Model, HSM

The Heuristics-Systematic Model (HSM), this model believes that people may have different processing methods when considering the information they receive. One is systematic processing. The first is systematic processing, and the second is heuristics processing. The HSM perspective assumes that the persuasive effect can be produced after the message recipient receives the message through agile processing or systematic processing. Make the recipient of the message agree or disagree with the message (Chaiken, 1987; Chaiken and Eagly, 1983). Among the two processing modes, systematic processing allows the message receiver to focus more on the goods and services, and consumers need to spend more effort to understand the quality of the goods and services themselves. JIS processing makes consumers tend to use peripheral cues to infer the quality of goods and services and make decisions quickly; many past studies have adopted the HSM perspective to detect these JIS cues, including source expertise, favorability, message length and brand name etc. (Ling Yiling, Liu Yifen, 2008).

2.2 Online incivility

Uncivilized comments on the Internet are more likely to attract the attention of others (Mutz and Reeves, 2005). According to the negative bias Negativity bias theory

states that when people make decisions, negative information is more informative and they rely more on negative cues than positive or neutral cues (Kanouse and Hanson, 1987; Rozin and Royzman, 2001). Through the use of social media, customers can communicate their experiences with more other customers (Alalwan et al., 2017). Compared with traditional word-of-mouth marketing, online word-of-mouth (eWOM) has greater influence and reach (Hudson et al., 2015). Among them, "online comments" is an issue worth exploring, and uncivilized behavior is a very common phenomenon in online news comments (Coe et al., 2014). Whether it is domestic or foreign reporting, uncivilized comments generated by online news are highly prevalent. Uncivil behavior has had different interpretations in the past. In the workplace, many behaviors, such as leaving jammed printers and not replying to emails, have been interpreted as uncivil behavior. (Johnson and Indvik, 2001; Martin and Hine, 2005). The operational definition of uncivilized behavior includes profanity, slander, wrong messaging, exaggerated statements, etc. (Masullo et al., 2019).

2.3 Argument Strength

Argument strength refers to the perceived "persuasiveness, quality and convincingness of the argument" by the message recipient. Numerous studies have confirmed that argument strength will directly affect the attitude of the message recipient, especially online. This is especially true in environmental conditions (Erenberg et al., 1999; Petty and Cacioppo, 1986). High argument intensity can stimulate readers to think more about the message, and different argument types in comments can receive different degrees of scrutiny from comment readers (Winter et al., 2015). Based on previous literature, this study uses "argument strength" as the independent variable and proposes the H1 hypothesis. Under the comments of uncivilized users, compared with low intensity, high intensity has a more significant impact on consumers' message adoption intention.

H1: Compared with uncivil comments with low argument strength, high argument strength has higher adoption intention toward message.

2.4 Valence

Valence can be used to judge the credibility of information (Grewal et al., 1994). The content of the message conveyed describes the direction as positive or negative. Negative word of mouth has a greater impact on message adoption than positive word of mouth (Kanouse, 1984; Weinberger et al., 1981). Valence is also reflected in

comment feedback. The difference in the number of feedback can indicate the acceptance of the uncivil comment by the recipients of the message. (Rosenthal-von der Pütten et al., 2019). When the comment feedback ratio is "positive", readers will increase their recognition of uncivil comments. This type of clue can inspire readers to "trust the popular decision" (Axsom et al., 1987). Based on the above, this study proposes hypothesis two:

H2: There is a significant interaction effect between argument strength and review feedback valence on adoption intention toward message.

H2a: Under high feedback valence, low-intensity uncivil comments will have higher message adoption intentions than high-intensity ones.

H2b: Under low feedback valence, high-intensity uncivil comments will have higher message adoption intentions than low-intensity ones.

User-related information can help people build understanding of unfamiliar users, thereby helping users judge the credibility of information (Akram et al., 2018; Chu and Kim, 2011; Daugherty et al., 2008; Yang et al., 2019). The number of followers reflects the extent to which people are connected and is often used to identify the influence of community users (De Veirman et al., 2017). This study explores the interaction between the proportion of followers and the strength of arguments. Will it have a significant impact on adoption intention? Naming this variable "follower valence", this study proposes hypotheses H3, H3a, and H3b, believing that follower valence will have a significant impact on "message adoption intention" in uncivil comments.

H3: There is a significant interaction effect between argument strength and follower number valence on message adoption intention.

H3a: Under high follow-up valence, low-intensity uncivil comments will have higher message adoption intentions than high-intensity ones.

H3b: Under low follow-up valence, low-intensity uncivil comments will have higher message adoption intentions than high-intensity ones

2.5 Information adoption

Previous research has shown that persuasive online word-of-mouth (eWOM) messages will increase consumers' acceptance of information and affect eWOM adoption intentions (Chong, 2014). Information adoption intention (information

adoption): Whether people have influenced their existing attitude towards the product or service after reading online consumer reviews, and then formed a behavioral intention towards the product or service. This is assessed through the information adoption intention scale. , can predict whether the information consumers actually provide based on online word-of-mouth influence the final decision-making behavior.

3. Research method and Result

This study adopted an experimental design method and was conducted in three stages. The first stage was a single-factor experiment, and the second and third stages were a 2×2 two-factor experiment method to verify the research hypotheses in sequence.

3.1 Experiment 1: The impact of argument strength on message adoption intention

Experiment 1 explores the impact of "argument strength" on "message adoption intention", compared with low-strength informality. Compared with clear comments, high intensity has higher message adoption intention (H1). The research model is shown in Figure 1.

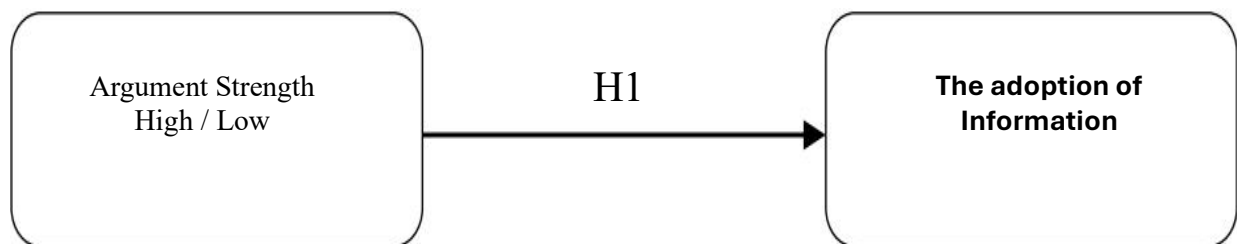


Figure 1: Research model of Experiment 1

3.2 Definition on Variable operation type

(1) Independent variable - Argument strength

Argument strength has been measured in many ways in the past. Researchers have a single measure of the strength of the message's argument. (Darke and Chaiken, 2005; DeBono and McDermott, 1994), or multiple items are combined into one perception questionnaire based on theory. Usually the items include "is it convincing", "is it convincing" and "level of argumentation", etc. (Andrews and Shimp, 1990; Lavine and Snyder, 1996; Munch and Swasy, 1988). In this study, subjects were first asked to read an uncivilized comment about a food delivery platform, and then answer relevant arguments. A question of strength. The manipulation test for perceived argument strength uses three questions from Zhao et al., (2011)'s perceived argument strength

scale. The first and second questions are "The review is credible" and "Persuasive" respectively. Answers The method is measured on a five-point Likert scale (Likert, 1932). The third question is the degree of explanation, which is expressed by adjectives for the convenience of the subjects (1 = "extremely far-fetched", 5 = "extremely reasonable"). Subjects will be randomly assigned to one of two situations, with argument intensity divided into "high" and "low". The "high intensity" situation will be classified as "objective". The "low-intensity" situation is described as "subjective ideas and not supported by data". A pioneer test (independent sample t test) was conducted on the strength of the argument, and situational questionnaires were randomly assigned. A total of 71 valid responses were completed. Perceived argument strength scale instrument reliability (Cronbach's $\alpha=.892$), with high strength ($M = 2.96$, $SD = .94$) is higher than low intensity ($M = 2.04$, $SD = .998$), and there is a significant difference between the two Different ($F = 16.08$, $p < .001$), the result is enough to reflect that the pretest of argument strength has high validity.

(2) Dependent variable - Information adoption

The scale is adapted from the Information Adoption Scale (Information Adoption Scale) developed by Cheung et al., (2009) Adoption Scales), with options ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree". Based on the research topic "Reviewers' Uncivilized Comments on Food Delivery Brands", the results are combined, as shown in Table 1.

Table 1 Message adoption intention scale

variab	Content	literatur
Information adoption	1. Base on the comments, I will refer to the comments of user○○○ on "Uber Eats delivery platform.	Cheung et al.(2009) (2009)
	2. Base on the comments, the comments of user○○○ can help me understand "Uber Eats delivery platform".	
	3. Base on the comments, the comments of user○○○ make it easier for me to decide whether to use "Uber Eats delivery platform".	
	4. Base on the comments, the comments of user○○○ will affect my motivation to use or not use "Uber Eats delivery platform".	
	5. Base the comments, the comments of user○○○ make me decide whether to use "Uber Eats delivery platform" more quickly	

(3). Subject outline

The questionnaire distribution period was from March 17 to 28, 2012, and a total of 62 responses were effectively collected. The message adoption intention scale has reliability (Cronbach's $\alpha=.91$). There were 24 males (38.7%) and 38 females (61.3%); the education level is mainly graduate school (including) or above 28 people (45.2%), and 28 people (45.2%) are college students; the age distribution is 16-25 years old, 49 people (79%) are the main age group, followed by Eight people (12.9%) aged 26-35 were the next most common.

(4). Manipulation test

The variable "argument strength" was manipulated in Experiment 1, and the perceived argument strength scale has reliability.(Cronbach's $\alpha=.90$), there is a significant difference in the subjects' perception of the two design contents (M low intensity=2.35 vs. M high intensity=3.25, $F = 8.77$, $p < .01$), that is, it was valid and the manipulation was successful.

(5). Hypothesis test

This study uses argument strength as the independent variable and message adoption intention as the dependent variable for single-factor variation. Numerical analysis shows that when argument strength is manipulated, high-strength message adoption intentions are greater than Low intensity (M high intensity = 3.31 vs. M low-intensity = 2.78 , $F=6.03$, $p < .05$), meaning that the argument is not strong Civilized comment content makes message viewers more willing to adopt it, while low-intensity content makes others more. As shown in Table 2, hypothesis 1 is supported.

Variable		Population	Average	SD	F
Argument Strength	Strong	29	3.31	.82	6.03*
	Weak	33	2.78	.87	

* $p < .05$

Table 2. Experiment 1 Single-factor Variance Analysis

2. Experiment 2: The impact of comment feedback valence on message adoption intention interference

2-1. Research Methods

2-1-1. Research model

Experiment 2 continued to explore the impact of "argument strength" on "message adoption intention" in uncivil comments. The research structure of Experiment 2 is shown in Figure 2.

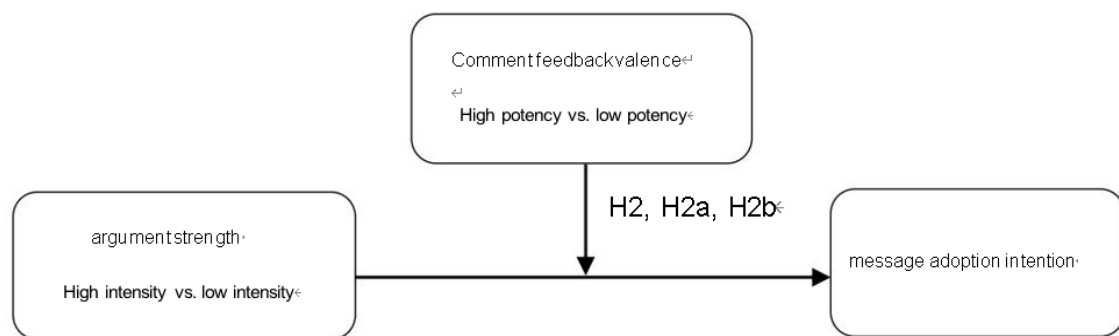


Figure 2 Research model of Experiment 2

2. Variable operation type definition

(1) Independent variable - review feedback valence

This study defines review feedback as “the reviewer’s response compared to other user reviews. The number of likes received can have a positive or negative impact on the comment. "In past research, the number of comment feedback was designed as single digits (or double digits) versus three digits. For example, Kim and Gonzales (2022) set the number of likes at 7:115 and 243:23, respectively. This is used as a reference for design, see Appendix 2 for details. This variable tests whether the high and low valence of comment feedback corresponds to the subject's perception. Subjects are asked on a five-point scale, such as: "Compared with another comment, how many likes do I think this comment has received?" Will make others feel..." Options range from 1="very negative" to 5="very positive", 1="very bad" to 5="very good" and 1="very unsatisfactory" to 5=" "Very satisfied", the average score is above 3.

Below is a negative perception, and an average above 3 is a positive perception. The pretest reliability (Cronbach's $\gamma = .943$) met the standard, with more feedback ($M = 4.09$, $SD = .54$) being higher than less feedback ($M = 2.38$, $SD = .65$), and there was

a significant difference between the two. Difference ($F = 122.38, p < .001$), as shown in Table 6, the pretest results have high validity.

(2) Research results and hypothesis verification

1. Subject outline

The subjects were randomly assigned to four situations: 2 (argument strength: high and low) The reliability of the message adoption intention scale was determined by excluding 19 invalid feedback questionnaires (Cronbach's $\alpha = .93$). There are 45 men (33.8%) and 88 women (66.2%); the education level is mainly university, 80 people (60.2%); the age distribution is 16-25 years old, 100 people (75.2%) are the main age group.

2. Manipulation test

The variable "argument strength" was manipulated in the experiment, and the argument strength scale was reliable (Cronbach's $\alpha = .88$). There was a significant difference in the participants' cognitive argument content for the two designs ($M_{\text{high strength}} = 3.48$ vs. $M_{\text{low strength}} = 1.98, p < .001$). low valence, high feedback valence Review feedback valence has reliability (Cronbach's $\alpha = .87$), low intensity = 2.52, $F = 51.27$. Compared with will have a more positive view of the review content itself ($M_{\text{high valence}} = 3.15$ vs. $M_{\text{low potency}} = 1.98, F = 61.59, p < .001$), both tests are valid, and Experiment 2 was successfully conducted.

3. Hypothesis test

In the following, "Argument Strength" and "Comment Feedback Valence" are used as independent variables, and "Information Adoption" Perform a two-way univariate analysis of variance for the dependent variable.

(1) Interaction analysis

This study used two-factor univariate variance analysis to examine the interaction effects between variables. The results showed that, there is a significant interaction between argument strength and review feedback valence on message adoption intention ($F = 3.96, p = .04 < .05$). The analysis summary is shown in Table 2, so hypothesis 2 is supported.

Source	Type III sum of squares	df	Average sum of squares	F
Argument strength	46.93	1	16.93	34.18***
Valence	39.41	1	39.41	79.58***
Argument strength x Valence	1.96	1	1.96	3.96*
Deviation	62.40	126	.49	
Total	124.49	129		

* $p < .05$, ** $p < .01$, *** $p < .001$

Observe the bar chart, as shown in Figure 3. Its shape is non-ordinal, although it is efficient. The low-intensity content of the price increased the mean message adoption intention ($M=3.30$), but still did not surpass the high-intensity content. For the high intensity of valence ($M=3.77$), the experimental results were not reversed, so hypothesis 2a was not supported. Under low feedback valence, compared with low intensity, high intensity has higher message adoption intention, so H2b is supported.

(2) Experiment 2: Simple main effect analysis

The mean scores between high and low intensity of "high potency" are both higher than 3 points (M high intensity = 3.77 vs. M Low intensity = 3.30, $F=8.45$, $p < 0.01$), no matter it is strong or low intensity, high feedback valence makes subjects more accepting of uncivilized content; in "low valence", it can be found that the average number of adoption intentions There is a significant difference between high and low intensity (M high intensity = 2.92 vs. M low intensity = 1.95, $F = 28.08$, $p < .001$), with an average difference of 0.96, indicating that the level of "low feedback titer" significantly reduces high and low intensity. Low-intensity message adoption intention, and the average scores of both argument strengths are lower than 3, make subjects less likely to accept the content of the comment. "Low feedback valence" overall reduces the average number of adoption of uncivilized messages, and compared with "high feedback valence" cues, argument strength under "low feedback valence" has more influence on message adoption intention.

3.Experiment 3: tracks the impact of number valence on Information adoption interference.

3-1.Research Methods

3-1-1.Research model

Experiment 3 will examine how the independent variable "valency of followers" affects argument strength on Information adoption. The relationship between the graphs and the research architecture are shown in Figure 4.

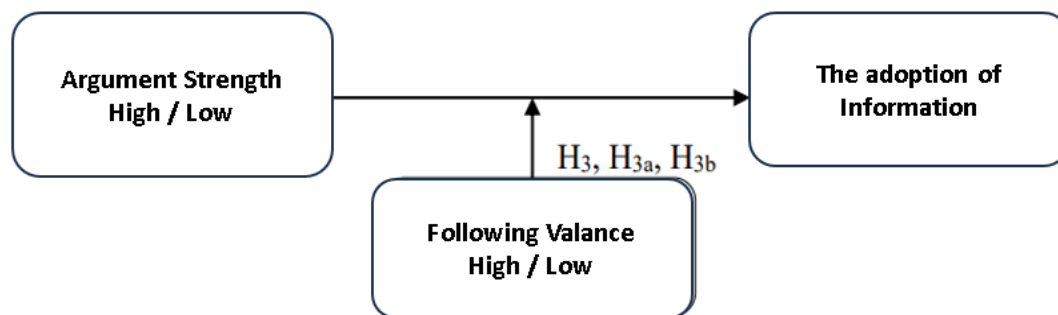


Figure 4 Research structure of Experiment 3

2. Variable operation type definition

(1) Tracking the number of people and their effectiveness

According to research by Cheng and Ho (2015), when the professionalism of the review source and the number of followers are higher, consumers will think that the review is more practical and useful. Consumers may decide based on the surrounding Judgments are made based on cues, such as the number of fans and followers (Maheswaran, 1994; Metzger and Flanagin, 2013; Petty and Cacioppo, 1986). In the social media Instagram, influencers have a large number of fans. Most of these influencers have an average of about 2,000 fans (De Veirman, 2017). Therefore, this study sets the number of fans at more than 2,000, and the relative number of fans is 20-30 is a small amount, see Appendix 3 for details.

(2) Research results and hypothesis verification

1. Subject outline

Subjects will be randomly assigned to 2 (Argument Strength: High vs. Low) x 2 (Number of Followers Valence: High and low) one of four situations. A total of 19 questions including demographic questions were distributed through an online questionnaire. environment questionnaire. The collection period was from April 27 to

May 20, 2012, and a total of 130 feedbacks were effectively collected. Excluding 15 invalid questionnaires, the reliability of the message adoption intention scale (Cronbach's $\alpha=.91$), there were 57 males. (43.8%), 73 (56.2%) were female; 98 (75.4%) were mainly college students by education level; age The distribution is 63 people (48.5%) aged 26-35, which is the main age group.

2. Manipulation test

Experiment 3 conducts a manipulation test on "argument strength" and "following number valence". Strong perceptual argument The measurement scale has reliability (Cronbach's $\alpha=.85$), and the subjects' cognitive argumentation content for the two designs has Significant difference (M high intensity = 3.58 vs. M low intensity = 2.92, $F = 22.73$, $p < .001$). Tracking number of people quotation letter. It is reliable (Cronbach's $\alpha=.84$). Compared with negative valence, positive tracking valence will have an impact on the review content itself. had a more positive view (M high valence=3.49 vs. M low valence=2.67, $F= 46.69$, $p < .001$), two tests. All are valid, and Experiment 3 was successfully conducted.

3. Hypothesis

(1) Analysis of interaction results in Experiment 3

This study used two-factor univariate variance analysis to examine the interaction effects between variables. The test results It shows that there is no significant interaction between argument strength and follower number valence on message adoption intention ($F=.09$, $p=.76 > .05$), the summary of variation analysis is shown in Table 3, so hypothesis 3 is not supported because there is no interaction effect. As a result, hypotheses 3a and 3b are not valid.

Source	Type III sum of squares	df	Average sum of squares	F
Argument strength	6.81	1	6.81	9.45**
Track people's effectiveness	4.23	1	4.23	5.86*
Argument strength x number of followers Valence	.06	1	.07	.09
Deviation	90.86	126	.72	
Total	102.02	129		

* $p < .05$, ** $p < .01$

Table 3: Summary table of variation analysis of Experiment 3

Observing the research results of Experiment 3, since there was no interaction effect in the results of Experiment 3, we discussed the main effects. First, in terms of argument strength, there was a significant difference in message adoption intention (M high intensity = 3.46 vs. M low intensity = 3.00, $F = 9.45$, $p < .01$), the mean difference is 0.46. The experimental results indicate that high intensity is more acceptable than low intensity. Uncivilized comments are more acceptable (H1). When the number of followers shows high valence, subjects will be more willing to adopt the uncivil comment content of the former than those with low valence (M high valence = 3.40 vs. M low valence = 3.04, $F = 5.86$, $p < .05$). The results of Experiment 3 are drawn into a bar graph, as shown in Figure 5. Since the two factors do not interact, the high and low intensity of high and low tracking valence are arranged in parallel, although the argument intensity and tracking feedback valence have different effects on each other respectively. Information adoption intentions are both influential, but do not influence each other.

4. Summary and discussion of research results

Observing the research results, we know that argument strength and review feedback valence have an interactive effect on information adoption. (H2), and the valence of the number of people being tracked have no influence on each other (H3).

(1).Argument strength has a significant impact on information adoption.

In the three experiments of this study, strong and low-intensity content were used as a comparison of persuasiveness. High-intensity uncivil comment content was more effective in making message recipients adopt the information and had a higher intention to adopt the information. Figure 1 shows that low intensity generally leads to lower information adoption intentions in uncivil comments, while stronger arguments still make message recipients more likely to accept uncivil messages. From the perspective of HSM, three experiments confirmed the significance of systematic information processing.

(2). Argument strength and review feedback valence have a significant interactive effect on adoption intention

Experiment 2 added comment feedback valence to explore the relationship with argument strength and message adoption intention. Argument Intensity interacts with the valence of comment feedback, and when high intensity encounters high feedback

valence, or low intensity encounters low feedback valence, the information adoption intention will be extreme, both of which will affect the reader's attitude towards the delivery platform. Perception, motivation and decision-making intention of whether to use it. The JIS cues had a greater influence, making subjects more likely to adopt a JIS information processing approach. Uncivilized comments advocate that "this delivery platform should not be used." Comments with high feedback valence greatly increase readers' adoption of this point of view, while uncivilized comments with relatively low feedback valence still encourage message recipients to think and Receive the message, but compared to other messages, it does not receive a certain number of "recommendations", so it is difficult for the argument to impress the message recipient. Although high intensity at low feedback valence contains more powerful narrative content, fewer review feedback still makes adoption Accepting the intention tends not to adopt it.

(3). There is no significant interaction effect between argument strength and follower number valence on message adoption intention.

The hypothesis of Experiment 3 was not supported. The main effects of argument strength and valence of number of people tracked were both correct. Adoption intention has a significant effect. As a clue to the message source, although the number of fans of the message source affects the reader's perception of the information, it does not interact with the strength of the argument. Readers can Whether the uncivilized message can be adopted will be judged based on the number of followers and the strength of the argument. Examining the main effect, the influence of argument strength is greater than the valence of number of followers, which shows that in Experiment 3, systematic messages. The impact of processing is greater than that of GIS message processing.

5. Conclusions and suggestions

(1). Theoretical contribution

Previous literature did not mention the application of HSM theory to the processing of uncivil messages on the Internet. This study combined uncivil messages on the Internet with consumer comments based on social media to repeatedly test the impact of argument strength on information adoption intention. Later, we added the influence of JIS cues on the systematic information processing process, and observed

the differences through JES cues with different attributes. The results of the study show that: JS cues will affect the degree of influence of systematic message processing, but the attributes of JS cues are the reason for the influence. If JS cues are related to uncivil comments, they will modulate the influence of systematic messages. The influence of systematic message processing; if the simplistic clues are related to uncivilized message sources, they will not modulate the influence of systematic message processing. However, simplistic messages and systematic messages are still carried out at the same time. The results show that systematic messages will be affected by Comments that judge the quality of the message feed back to Jiesi and influence public thinking. The clue of the number of followers of the message source directly affects the message recipient's message adoption intention, but does not moderate the degree of argument strength on the adoption intention.

(2). Practical implications

Tsao and Hsieh (2015) believe that the reason why online consumer reviews are influential comes from providing consumers with information about goods and services that are different from those created by brands, and being able to provide information on whether the goods and services are acceptable in the market. Welcome messages have a huge impact on consumers' shopping decisions. Consumer feedback on the Internet is part of an integrated marketing tool (Moorman, 2014). More and more brands and businesses are willing to allocate marketing budgets to "generate" and "manage" consumer reviews, even if they cannot solve the problems caused by negative reviews. Positive responses from industry and brands will alleviate the negative reviews caused by On the impact. Strong negative arguments and comments will affect other people's attitudes towards the brand or service. In social media management, if you encounter negative word-of-mouth published by consumers, you may wish to regard it as an opportunity to remedy it to turn crisis into opportunity.

(3).Future research directions

The study was based on the source of JESC cues (tracking people's valence) and the JESC cues related to reviews (reviews Feedback valence) explores the information processing process. Past research has examined and tested JESC cues in different ways. Future research can add different attribute clues to the uncivilized background of the Internet, such as website layout order, popular comments and general comments, etc.,

to deeply explore the reasons for the impact on consumer decision-making behavior. another systematic Messages can be presented in different ways. This study is about comments under social posts. If it is expanded to the message publishing mode in different functions, it may also affect the results.

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Sustainable Competitive Advantage and Firm Performance in Thailand's Small and Medium Enterprises

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Abstract

The ongoing trend toward globalisation makes competition increasingly challenging for businesses, making survival a crucial goal. The methods by which enterprises gain and sustain their point of differentiation in industries are fundamental to their survival. This research examines the elements that contribute to sustained competitive advantage and their impact on business performance within the context of Small and Medium Enterprises (SMEs). The competitive situation in industries is examined through the resource-based view (RBV), which highlights four key factors that influence competition: relationship benefits, business strategies, specific advantages related to resources, and government impact. This research employed a questionnaire survey and structural equation modelling to evaluate the conceptual framework. We found that relational advantages, factor-specific advantages, and business strategies can lead to improved performance. The benefit of having good relationships helps a company perform better by providing information for government support. Additionally, business strategies that utilise these specific advantages also improve company performance, and government assistance in growing those advantages further enhances overall performance. Further empirical research could enhance this study's conceptual model by incorporating other national economies, types of firms, and geographical contexts.

Keywords: *sustainable competitive advantage, firm performance, Small and Medium Enterprises*

1. Introduction

Small and Medium Enterprises have been important in the development of rapid economic growth in many Asian countries, such as Japan, the Republic of Korea, and Singapore, as well as in the territory of Hong Kong (Connell, 2014; O'Connor & Gu, 2012; Milim, 2011). Thailand is also one of the countries that actively promotes small and medium-sized enterprises (SMEs) by encouraging the adoption of technology and innovation to drive business sustainability and self-reliance in the future, with support from both public and private sector organizations (Sriboonlue & Puangpronpitag, 2019). In an era marked by rapid technological progress and borderless, unrestricted trade driven by Internet connectivity, entrepreneurs can reach customers more quickly. In contrast, customers can access information and purchase products with greater ease (Wongkhamdi et al., 2020). The era of globalization has rendered competition more challenging for organizations, making survival a paramount economic priority. Consequently, companies should concentrate not only on achieving competitive advantage but also on ensuring its sustainability. (Ranjith, 2016). In the past, Thailand's small and medium-sized enterprises (SMEs) have continued to require support in areas such as logistics and technological knowledge and have faced ongoing challenges in marketing, as well as in accessing government services—particularly for smaller organisations—and obtaining appropriate sources of funding (Traithaiteera, 2019).

We integrate Porter's (1998) diamond model into our framework to identify four environmental factors—factor conditions of use, conditions of demand, the supporting and related sectors, and business strategy, structure, and rivalry—alongside one external factor, the government, which significantly enhances a firm's productivity, thereby fostering competitiveness within the industry. Research has increasingly emphasised internal firm resources and capabilities as tools to enhance firm performance. These studies use the popular resource-based view (RBV), as this can explain performance heterogeneity at the firm level. (Fahy, 2002). We endeavour to integrate these two concepts to develop a theoretical background and related hypotheses.

The next sections of this work are organized as follows: The initial section delineates the sources of sustained competitive advantage for enterprises and presents a conceptual framework. The subsequent section delineates our methodology. The third

section presents the research findings. The concluding section examines the consequences of the findings, outlines the study's limitations, and provides recommendations for future research.

2. Conceptual development: Sources of sustainable competitive advantage

Competitive advantage is a prevalent concept across several domains, and its cultivation has emerged as a fundamental strategy for enterprises (Zhao et al., 2009). Competitive advantage is characterized as a strategic superiority that a corporation holds over its competitors, enabling it to achieve leadership within its industry (Bashiri et al., 2013). A company's resources and capabilities can create a sustainable competitive advantage if they are rare, valuable, difficult to imitate, and hard to substitute (Barney, 1991). These resources and competencies can be regarded as collections of both tangible and intangible assets (Barney et al., 2011). External resources can generate a competitive advantage, as highlighted in Porter's (1998) diamond model, which further illustrates the importance of government involvement.

Many studies have utilized Porter's (1998) framework to examine the characteristics of the environment in which the firm competes and promotes its competitive advantage (Esen & Uyer, 2012; Özer et al., 2012; Erboz, 2020). Porter (1998) explained that the nature and sources of competitive advantage widely differ among industries, and firms must isolate national effects on their ability to compete in a specific industry and employ particular strategies. Porter's diamond model analyses why some countries are more successful in particular industries than others (Tsai, Chen, & Yang, 2021). Furthermore, Porter's framework was developed to measure firm-level competitiveness and is an important model for explaining national competitive advantage (Bakan & Dogan, 2012).

The resource-based view: Factor-specific advantages

Various studies have highlighted factors in firms' strategic planning and the attainment of competitive advantage based on the resource-based view (RBV) (Walters et al., 2008; Ghapanchi et al., 2014; Evans, 2016). A firm's resource-based view can provide explanations for how a firm sustains its competitive advantage against other firms (Matthews & Shulman, 2005). Firms possess various types of resources and capabilities; among these, several are strongly associated with better performance

(Kamboj et al., 2015). Further, Shen et al. (2018) suggested that intellectual capital is the core factor in achieving successful firm performance. Intellectual capital is commonly categorized into three types: human, social, and structural capital (Barney, 1991; Starovic & Marr, 2004).

Porter's diamond model

Porter's (1998) model not only explains the collaboration and networking that occurs between the government and industry but also determines national advantage through four broad attributes. These shape the environment in which local firms compete and can either promote or impede competitive advantage. The model views a firm's competitiveness as determined by these four major factors: factor conditions, demand conditions, related and supporting industries, and the firm's strategy, structure, and rivalry. All factors within the diamond model are characterized as interdependent (Boja, 2011).

Government organisation

A partnership with the government is beneficial, providing a corporation with both concrete advantages, such as access to resources, and abstract advantages, such as endorsement from influential institutions (Li & Zhou, 2010). The government can assist in mitigating the pressures on a company to enhance and modernize after it has forfeited its competitive edge (Porter, 1998). Moreover, Cardoza et al. (2016) propose that both local and national governments can influence the worldwide expansion of SMEs by offering these enterprises the chance to progress along a learning curve. As a result, these organizations can cultivate the necessary competencies to compete throughout this process. The government is frequently regarded as the key entity accountable for critical sectors, including elementary and secondary education, fundamental infrastructure, and research on significant societal issues (Porter, 1998).

Relationship with related and supporting industries

Fan et al. (2013) classify firms' managerial ties into two types: business, such as relationships with suppliers, buyers and competitors, and political. Working with buyers, suppliers, and other business channels involves helping these connections enhance and expand their competitive advantage (Porter, 1998). Furthermore, all successful industries face substantial challenges in relating to and supporting other

industries (Mehrizi & Pakneiat, 2008), as surmounting these challenges is necessary for firms to exchange knowledge and technologies regarding new products and services. The network of relationships between a firm and its stakeholders is also a key strategic resource (Kull et al., 2016). In summary, the relationship between a firm and other institutions and government organizations enables firms to gain policies that support their business operations. Therefore, we hypothesize the following:

H1: The relationship advantage from government support enhances firm performance.

Government incentives are a basic, country-specific resource (Fahy, 2002). The government's role involves creating and upgrading, whether these include skills, human resources, or basic knowledge (Porter, 1998). On the one hand, the government's involvement is a critical determinant of an industry's competitiveness (Yeung & Mok, 2002). As a significant force within any country, the government consistently impacts effective competition and intervention through different political, social and economic rules and practices (Bashiri et al., 2013). In the competitive development of an industry, the government has an important but indirect effect, as it is considered an exogenous variable (Porter, 1998).

On the other hand, Öz (2002) considered the government's role, as it provides such direct support to industries as subsidies. Shen et al. (2018) also suggested that the core factors in the government's support of creative and cultural industries include approving land development and opening investment policies, safety and security measures, and industrial innovation programs. These variables are expected to enhance the competitiveness of SMEs. The government should strive to foster an environment that enables enterprises to enhance their competitive edge in existing industries by adopting innovative technologies and methodologies, as well as by entering more sophisticated market segments (Porter, 1998). Consequently, we assert that

H2: Government practices will significantly influence factor-specific advantages.

Business strategy

Declining industries lack effective firm strategies and structures (Dögl et al., 2012). Moreover, customer demand conditions are incorporated into a business strategy because such demands enhance domestic rivalries, for example, when customers

demand that domestic buyers seek multiple sources (Porter, 1998). Customer demand also helps clustered firms compete more successfully in markets (Viederyte & Didziokas, 2014). Customers' voicing of preferences is vital in understanding market drivers, which might affect the *organization's* long-term competitive ability and sustainability (Lertpachin et al., 2013). Should the nation encounter elevated demand within its goods industry, enterprises will proliferate in that domain. Particularly, discerning and exacting consumers might compel local companies to adhere to elevated standards for the quality, features, and associated services of their products (Porter, 1998). Consequently, companies' strategic planning regarding consumers and competition enhances factor-specific advantages and improves performance. Therefore, the subsequent hypothesis is as follows.

H3: Business strategy enhances firm performance through factor-specific advantages.

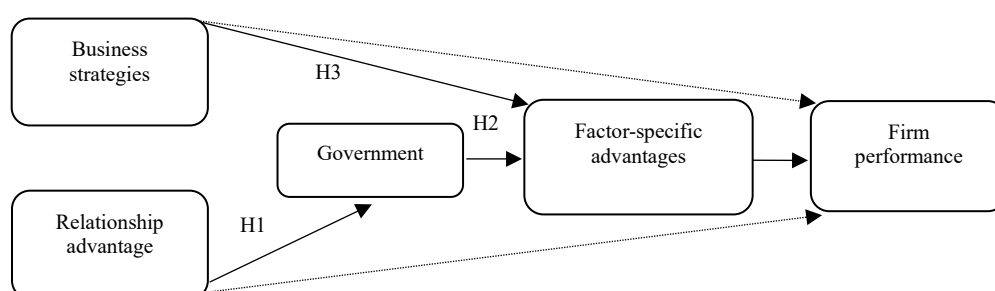


Fig. 1. The conceptual model

3. Method

3.1 Sampling and data collection

The objective of this study is to measure sustainable competitive advantage, which influences firm performance in the Thai business context. To test our hypotheses, we investigated small and medium-sized enterprises (SMEs) in Thailand. We employed Taro Yamane's approach, typically used to determine the sample size required to estimate population proportions, to determine the sample size for this study. We thought that 0.5% of the population would be included and that we would be 95% sure of this. As a result, the researcher gathered information from 400 individuals. For this study, which examines small and medium-sized firms in Thailand, purposive sampling was employed, a type of non-probability sampling.

The survey was segmented into two sections. The initial section was designed to collect data on company attributes, including business type and the number of employees. The second section addresses the elements pertinent to assessing sustainable competitive advantage. A sample of 30 entrepreneurs from small and medium-sized firms was utilized. We requested that they complete the questionnaire and offer suggestions regarding its format and any deficiencies. An examination of the pre-test survey revealed that participants comprehended all the questions. The Cronbach's alpha values for all items significantly exceeded the acceptable threshold of 0.7 (Fowler, 2009); thus, the foundational data was deemed internally stable and consistent. We then selected a random sample of 400 small and medium-sized firms from a list of firms that had enrolled with the Office of SME Promotion.

3.2 Measures

Various item scales were employed to assess our hypothesis. Various instruments were created to assess enterprises' sustainable competitive advantage and to delineate the settings of sustainable competitive advantage and its consequent impact on company performance. We employed a five-point Likert scale for all assessments of factor-specific advantage, governmental organizations, relational advantage, corporate strategies, and organizational performance. The elements contributing to a sustainable competitive advantage are examined by exploratory factor analysis (EFA) and subsequently confirmed through confirmatory factor analysis (CFA). Ultimately, the data analysis was undertaken using SPSS and AMOS software suites to evaluate the hypotheses of this study and fulfil its primary objectives.

4. Analysis and results

4.1 Respondents' characteristics

Questionnaire 400 complete samples were collected. The respondents' most popular business type was the community enterprise, followed by sole proprietorships and corporations, with frequencies of 32.8%, 29.8% and 28%, respectively.

4.2 Exploratory factor analysis (EFA)

We ensured the validity and reliability of the instruments used to examine sources of sustainable competitive advantage by performing an exploratory factor analysis (EFA) and calculating Cronbach's alpha. Four competitive advantage factors—factor-specific advantages, government organizations, relationship advantages and business

strategies—were applied in the EFA, and sustainable competitive advantage was extracted from 24 items; the total variance explained collectively by all factors is 66.19%, with Cronbach's alpha values of 0.85, 0.93, 0.89 and 0.89, respectively, and all items surpassed 0.60 for an exploratory study (Wu, 2013; Churchill, 1979). We extracted factors for cases in which the eigenvalue was greater than 1.0. The factor loadings for the 24 items ranged from 0.58 to 0.88, and all items exceeded the recommended threshold of 0.50 (Io, 2016). Support for competitive advantage was analyzed using the principal component analysis and varimax rotation method. The evaluation result indicated a Kaiser-Meyer-Olkin value of 0.84, and Bartlett's test of sphericity was significant; thus, the data is appropriate for factor analysis.

4.3 Confirmatory factor analysis (CFA)

We conducted a CFA to estimate construct validity, as noted in the Appendix. Five competitive advantage items were removed due to their low factor loadings, which did not fit the model. Cronbach's alpha values for all items ranged from 0.82 to 0.93, and each variable's item-total correlation was greater than 0.50, exceeding the recommended standard (Io, 2016). The model provides a desirable fit for the data ($C_{min}/df = 4.73$, CFI = 0.96, NFI = 0.95, GFI = 0.94, AGFI = 0.92, RSEMA = 0.06) (Hooper et al., 2008). All measurement items had standardised factor loadings that ranged from 0.51 to 0.97 and were significant at the alpha level of 0.001; the values should be greater than 0.50 (Io, 2016). Moreover, the results of the constructs' composite reliability (CR) ranged from 0.70 to 0.90, which are greater than the acceptable 0.70 levels, and the average variance extracted (AVE) ranged from 0.50 to 0.72, which is greater than the acceptable level of 0.50 (Fornell & Larcker, 1981; Jeong et al., 2014; Liu, 2017). We ensured discriminant validity by calculating the shared variance between all possible pairs of constructs to determine if they were less than the individual constructs' AVE (Fornell & Larcker, 1981; Li & Zhou, 2010). The results indicate that the AVE for each construct was much higher than its maximum shared variance (MSV) with the other construct, providing additional support for the discriminant validity.

4.4 Structural equation models and relationship testing

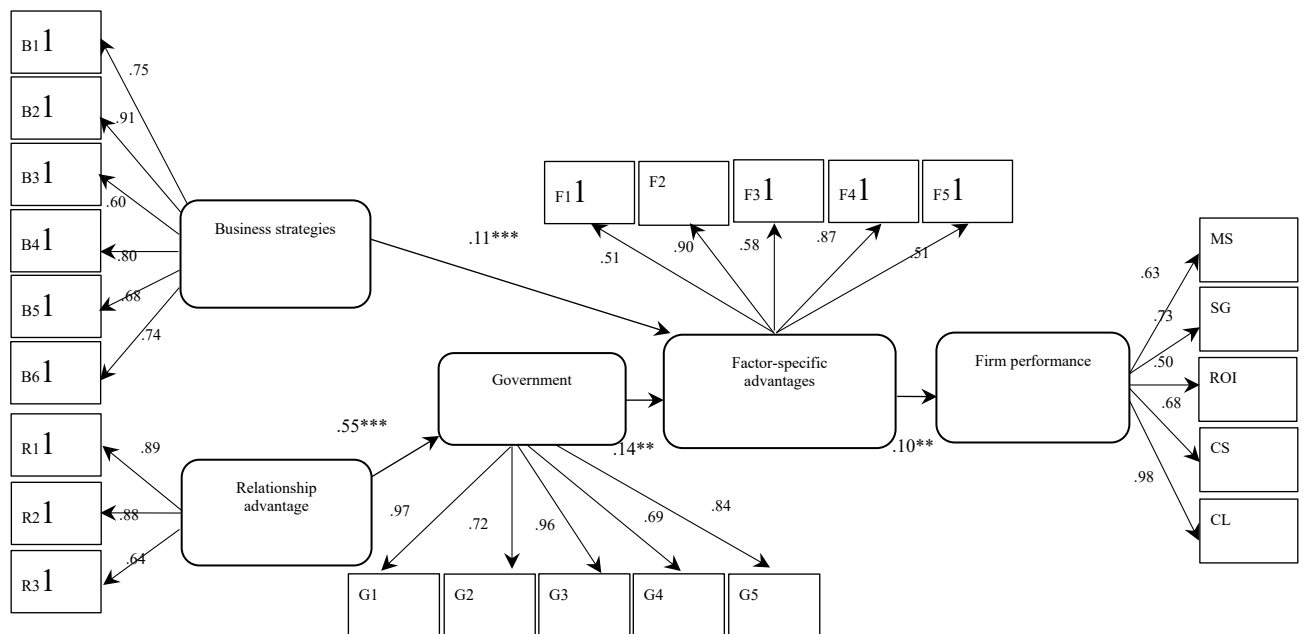
Structural equation modelling was used to ensure the validity of the proposed conceptual model illustrated in Fig. 1, and we investigated the relationships between two constructs: competitive advantage factors and firm performance. We test our hypotheses using a structural model with a maximum likelihood estimation. This study focuses on each competitive advantage component's effect, specifically, relationship advantages, business strategies, the government, and factor-specific advantages. We also test the mediating roles of the government and factor-specific advantages by directly connecting relationship advantages and business strategies to performance. Figure 2 illustrates the goodness-of-fit statistics for the proposed model, and indicates that the model reasonably fits the data ($C_{min}/df = 2.43$, $p < 0.001$; CFI = 0.98; NFI = 0.96; GFI = 0.95; AGFI = 0.97; RSEMA = 0.04). The results in Table 1 indicate that when the government is added into the model, the relationship advantages indirectly influence performance; therefore, when government was introduced, its significant impact on firm performance weakened ($\beta = 0.47$, $p < 0.001$), and this relationship advantage was not found to significantly or directly affect firm performance. Therefore, the link between relationship advantages and firm performance occurs through complete mediation by the government, which supports H1.

This result indicates that the government significantly impacts factor-specific advantages ($\beta = 0.14$, $p < 0.01$), which supports H2. Further, Hypothesis H3 involves factor-specific advantages' mediating role between business strategies and firm performance. Business strategies positively relate to specific factors ($\beta = 0.11$, $p < 0.001$), and factor-specific advantages ($\beta = 0.10$, $p < 0.01$) positively affect performance. However, business strategies do not have a significant, direct effect on performance when factor-specific advantages are included in the model. Therefore, factor-specific advantages completely mediate the relationship between business strategies and firm performance, thus supporting H3.

Table 1. Structural parameter estimates

Variable	Government	Factor-Specific Advantages	Firm Performance
Relationship Advantages	.55*** (20.98)	.04 (ns)	.01 (ns)
Business Strategies	.01(ns)	.11*** (3.33)	.05 (ns)
Government	-	.14** (3.02)	.47*** (14.53)
Factor-Specific Advantages	-	-	.10** (2.86)

Note: The *t*-values are noted in parentheses; ***p* < 0.01, ****p* < 0.001 and ns = not significant.



Note: *** *p* < 0.001, ** *p* < 0.01.

Fig. 2. Result of structural model regarding competitive advantage factors and their link to firm performance

5. Discussion and conclusion

A study framework has been proposed, with an emphasis on the key factors that can drive the sustainable competitive advantage of SMEs. This study also examined the direction and causality between firm performance and various sustainable competitive advantage factors—namely, relationship advantages, business strategies, factor-

specific advantages, and government involvement. The structural model supports our Hypotheses H1, H2, and H3.

This study expands the literature on competitive advantage by empirically investigating the support of government organizations, which is a significant indicator of sustainable competitive advantage, as Porter (1998) suggested in his diamond framework. The government has been considered a significant factor in variance in firm performance, as government organizations entirely mediate the relationship between related and supporting industries and firm performance. Many research studies across SMEs have indicated that government agencies play a key role in firms' competitiveness (Evens & Donders, 2016; Gamble et al., 2017). In the past, Thailand has experienced a lack of integration and continuity in its development policies, as well as a lack of driving mechanisms and efficient coordination with related industries. This category includes financial institutions in both the public and private sectors, which can provide supporting credit to entrepreneurs in smaller enterprises. However, problems often occur with collateral, regulations are too strict, and research and development continue to lack financial support (Traithaiteera, 2019). Therefore, government organizations are the key mediators that link firms and finance, as well as R&D institutions and customers, to mitigate such relationship problems. Institutional advantage also enables a firm to secure scarce resources (e.g., materials, capital, labor, or information) more effectively than its competitors (Li & Zhou, 2010). In addition, this study's results indicate that government organizations have a significant direct impact on firms' factor-specific advantages and can provide a better balance in direct support to firms. Therefore, local governments should prioritize different supporting policies for local firms, considering differences in culture, suppliers, and customers. Fahmi et al. (2016), for example, suggested that policy strategies should be tailored to the locality, as the same strategies for fostering business development may not apply to every region.

While specific factor-related practices contribute as mediators between business strategies and firm performance, the result is consistent with existing studies, such as those by Li and Zhou (2010) and Kamboj et al. (2015). Entrepreneurs must adopt a cautious approach to the long-term development of creativity, considering organizational characteristics, industry contexts, and competitive positioning and strategies. Our study contributes to the current literature in the following ways: First,

based on the resource-based view (RBV) and the diamond framework, we argue that internal environmental resources produce a sustainable competitive advantage. Our study tests new hypotheses generated by revisiting the diamond framework and RBV to provide a further theoretical explanation of how internal resources' advantages contribute to firm performance. Our analytic conceptual model is consistent with the diamond model and RBV and augments their original insights to specifically analyze factors of sustainable competitive advantage and their link to firm performance. Second, Porter's (1998) diamond model explains that governments can influence each of the four determinants (factor conditions, demand conditions, firm strategies and related and supporting industries). This study further clarifies government practices and their contribution as a mediator between related and supporting industries and firm performance.

This study has significant strategic implications for policymakers and small to medium-sized firms (SMEs). They must thoroughly understand that this research possesses considerable strategic ramifications for policymakers and small to medium-sized enterprises (SMEs). They must comprehensively understand the interconnections between research and development institutions, financial organizations, and clients to achieve a sustained competitive advantage. The relationships among research and development institutes, financial entities, and clients to achieve a sustainable competitive edge. The government plays a mediating role in the relationship, enabling companies to gain an advantage and achieve superior performance through government incentives and policies. The government's key intervention is its investment in innovation and research and development, which means investment in human and creative capital (Nurse & Ye, 2013). Financing is also important for firm growth, as inadequate financing inhibits growth (Fowowe, 2017). Such financing is of vital importance for businesses to expand their operations (Chittithaworn et al., 2011), indicating that investment and access to capital remain key issues (Panitchpakdi & Chambas, 2011). Further, the SME sector in many countries faces severe constraints in accessing formal financing (Quartey et al., 2017). Access to finance is also one of the most significant barriers to starting and growing a new business (Kerr & Nanda, 2009; Ottavia, 2014), and SME-financing policies can be perceived as a result of the government's intervention in the financial market to fill SME financing gaps.

To enhance long-term policy outlooks and maintain national competitiveness, government policies should incentivize the private sector to allocate greater venture capital and business-oriented investments to promote high-tech startups and SMEs (Wonglimpiyarat, 2016). Entrepreneurs must establish robust ties with buyers, as the value of these relationships will yield long-term advantages (Fan et al., 2013). Moreover, closeness to customers and continuous engagement with other companies are beneficial, as they can enhance enterprises' creativity (Liu et al., 2015). Due to the difficulty of replicating buyer desires (Fahy, 2002), a crucial strategy for establishing beneficial interactions is to foster strong connections with R&D and financial institutions, as well as with customers. Secondly, the Resource-Based View (RBV) and diamond structure assert that a corporation can achieve a sustained competitive advantage by investing in certain factors, including labor skills, research and development capabilities, product quality, creativity, and innovation.

Human capital is the essential element for achieving sustainable competitive advantage; this form of capital is distinctive and challenging to replicate (Todericiu & Stăniș, 2015). Consequently, companies ought to allocate resources towards knowledge generation and training to enhance human resource competencies within the SMEs (Nurse & Ye, 2013). Special attention should also be given to promoting knowledge dissemination and knowledge sharing among employees, which includes brainstorming, training, and collaborative projects with public sectors or related organizations to share new ideas and experiences. This will disclose novel operational procedures and unique products (Lee et al., 2016).

It is also important to focus on strategically important personnel who recognize the importance of knowledge as a competitive advantage (Massa & Testa, 2009). Further, the integration of learning and training in firms improves the quantity and quality of individual knowledge and ideas, facilitates employees' professional advancement, and significantly contributes to organizations' long-term growth (Dekoulou & Trivellas, 2014). As firms should identify expedient competitive advantages and choose their strategies accordingly, SMEs, in particular, must explore whether these strategies should focus on the customer or competitors. Our findings suggest that strategies involving the customer and competitor—such as improving and upgrading products, understanding customers' needs, driving the firm's objectives through customer satisfaction, discussing competitors' strengths and strategies, and

rapidly responding to competition—can enable a firm to achieve superior performance and create greater customer value.

However, a few limitations can be noted in this study. This study employed questionnaires with closed-ended questions and collected short-term data; therefore, the findings may not fully reflect the views and practices of entrepreneurs. A long-term research approach would mitigate specific concerns while introducing new inquiries, as organizations' development is dynamic and subject to change (González-Loureiro et al., 2015).

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How Does the Service Technologies Affect Customers' Intention to Dine at Restaurants? The Moderating Role of Technology Anxiety

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Abstract

Many businesses in the restaurant sector have used various service technologies to enhance consumer experience and thus expect to increase customer's intention to dine out. Yet it is little known about how the usage of service technologies can affect customers' intention to dine at the restaurants. The purpose of this study is to explore how the usage of service technologies can increase customer autonomy and brand competence, which in turn affects customers' intention to dine at restaurants. Data collected from 281 customers in Taiwan were used to test the proposed model. The results show that the usage of service technologies has positive influences on customer autonomy and brand competence, while customer autonomy impacts brand competence significantly. Our results further show that technology anxiety exerts a significant but negative moderating effect on the link between the usage of service technologies on intention to dine at the restaurants.

Keywords: Intention to Dine, Customer Autonomy, Brand Competence, Usage of Service Technologies, Technology Anxiety

1. Introduction

As the rapid development of information technologies, the rising labor costs, and the outbreak of Covid-19 pandemic, implementation of service technologies (e.g., self-service technologies and service robots) has emerged as a significant trend in the restaurant industry (Ma et al., 2022; Tuomi et al., 2021; Wan et al., 2021). To date, customers in many restaurants could use these service technologies to make reservations, order meals, obtain food delivery services using service robots, and use digital payment systems to foot the bill without direct contact with employees. The implementation of digital service technologies, if fact, has changed the service process in the restaurant industry (Ma et al., 2022), and facilitate customer experience and satisfaction (Wu et al., 2024). However, some customers still prefer high-contact services despite the convenience resulted from digital service technologies implementation (Lei et al., 2025; Davari et al., 2022). Hence, it is important to understand the effect of service technologies usage and customers' intention to dine at a restaurant and what may inhibit the intention to dine.

Several prior studies have examined the role of service technologies in the restaurant industry. For example, Ma et al. (2022) employed the perspectives of product level theory and experience economy to identify the antecedents of technology readiness of service robots. Kao and Huang (2023) extended the technology acceptance model to understand the predictors of customers' acceptance of robotic services. Huang et al. (2022) examine the effects of innovation and brand competence on customers' intention to use restaurants. Chen and Girish (2023) used the cognitive–affective–behavioral framework to understand the factors affecting approach behavior of service robots in the restaurant industry. Moriuchi and Murdy (2024) examined the influences of service establishment type and anthropomorphism of service robot on intention to dine in the restaurant.

While the above studies have provided useful insights, most studies focused on the role of service robots. If fact, many restaurants have employed various service technologies to support transaction and service delivery processes. Yet very little is known about how the usage of service technologies in the service delivery process can shape one's brand perception, which in turn impacts their intention to dine in the restaurant. In addition, technology anxiety is a critical threat inhibiting an individual's willingness to use information technologies (Kummer et al., 2017). Although

technology anxiety is not a new concept (Kummer et al., 2017), little attention has been paid to examine the role of technology anxiety in the restaurant industry.

To fulfill the knowledge gap, we develop a research model to understand antecedents of intention to dine at restaurants. In the model, this study considers that brand competence is a critical predictor of customers' intention to dine in the restaurant based on Huang et al. (2022). In addition, customer autonomy is treated as a factor to represent customers' perception about the extent to which they could control their decisions during service delivery process (Collins & Hoyt, 1972; Zhu et al., 2024) and further argue that the usage of service technologies may impact one's autonomy perception, which in turn affects their behavioral intention (Zhang et al., 2023). Moreover, the aspect of capability process of trust-building asserts that one may evaluate other's ability by assessing his/her needs could be satisfied in the social interactions (Kim et al., 2004). In this regard, customer autonomy could be regarded as a experience that could help customers to infer the competence of a brand. Finally, technology anxiety is seen as a factor that may moderate the relationships between usage of service technologies, customer autonomy, brand competence, and intention to dine in.

The remainder of the study is structured as follows. Section 2 presents the theoretical background and hypothesis. Section 3 describes the research methodology and section 4 demonstrates the data analysis results. Section 5, finally, presents a discussion about data analysis results.

2. Theoretical Background and Hypothesis

2.1 The effect of service technology usage on customer autonomy and visit intention

Autonomy is the freedom individuals have in conducting his/her behavior based on their own volition (Ahmad Husairi and Rossi, 2024; Wertenbroch et al., 2020). Customer autonomy in this study refers to the ability to develop purchase considerations without the impact of external forces (e.g., social influence, social pressure, and regulations) (Ahmad Husairi and Rossi, 2024). In the service industry, past research has found that high-contact services may increase social anxiety and embarrassment for some customers (Deng et al., 2024; Holthöwer and van Doorn, 2023). The implementation of digital service technologies (e.g., self-service technologies) in the restaurant industry, on the other hand, could enable customers to

make order decisions based on their willingness and thus reduce the concerns of social anxiety and embarrassment (Deng et al., 2024). As a result, we may expect that the usage of digital services in restaurants may increase customer autonomy perception and facilitate customers' intention to dine at restaurants.

H1: The usage of service technology is positively related to customer autonomy.

H2: The usage of service technology is positively related to intention to dine.

2.2 The relationships between service technology usage, customer autonomy, and brand competence

Brand competence refers to the extent to which customers believe that a brand owns the skills or ability to satisfy social interactions with customers (Hwang et al., 2022) and to deliver on its promise to customers (Fang, 2019). Past research argued that innovation is a vital predictor of brand competence (Hwang et al., 2022), since customers are more likely to trust in a brand with high level of innovation capability (Aaker, 2007; Hwang et al., 2022). Fang (2019) also found that the affordances of a information technology could increase one's value perception, which in turn facilitates their evaluation about brand competence. Based on the above arguments, we may recognize that the implementation of digital services may enable customers to believe that a brand possesses the ability to provide quality services for customers. Therefore,

H3: Customer autonomy is positively related to brand competence.

H4: The usage of service technology is positively related to brand competence.

2.3 The influences of customer autonomy and brand competence on intention to dine in

Customer autonomy and brand competence are expected to influence customers' intention to dine in. Prior literature argued that brand competence is a critical factor that could enable customers to infer whether a brand is credible and reliable (Fang, 2019). Generally, a brand with a higher level of perception of brand competence, customers may be more likely to believe that this brand could solve their problems and satisfy their needs (Butler, 1991; Butler & Cantrell, 1984; Hwang et al., 2022). Customers may thus be more likely to show brand loyalty (Lin, 2010; Hwang et al., 2022). Past research has demonstrated that brand competence has a positive influence on behavioral intention (Hwang et al., 2022; Fang, 2019). Thus,

H5: Brand competence is positively related to intention to dine.

In addition, autonomy has been considered as a vital predictor of an individual's behaviors (Zhang et al., 2023). In the organizational context, a higher sense of work autonomy may enable employees to achieve better development and growth and thus reduce turnover intention (Zhang et al., 2023). Ahmad Husairi and Rossi (2024) showed that customers tend to adopt AI systems when AI systems provide recommendations allowing them to believe that they are able to view available choices and narrow them into consideration sets to make final purchase decision without external influences (i.e., choice and decision autonomy). Accordingly, we expect that customers will tend to visit a restaurant when customers believe that they are able to make order decisions without external influences.

H6: Customer autonomy is positively related to the intention to dine.

2.4 The moderating role of technology anxiety

Technology anxiety refers to one's fear about using information technologies, such as the internet and computer (Thatcher et al., 2007). Technology anxiety is negatively related to technology usage because fear of using technologies will impact one's beliefs about technology usage (Kummer et al., 217). This implies that technology anxiety may reduce individuals' belief that they are able to use digital services to order meals by themselves. Accordingly, customers with high level of technology anxiety may be less likely to use digital service and thus will reduce the linkage between the usage of service technology on customer autonomy. In addition, without the experience of digital service, customers with high level of technology anxiety may not be able to evaluate the competence of the brand and infer that the level of reliability and competitiveness of the brand. Based on the arguments, we may propose the following hypotheses.

H7a: Technology anxiety has a negative influence on the linkage between the usage of service technology on customer autonomy.

H7b: Technology anxiety has a negative influence on the linkage between the usage of service technology on brand competence.

H7c: Technology anxiety has a negative influence on the linkage between the usage of service technology on intention to dine.

Based on the abovementioned arguments, the conceptual model that we propose is depicted in Figure 1.

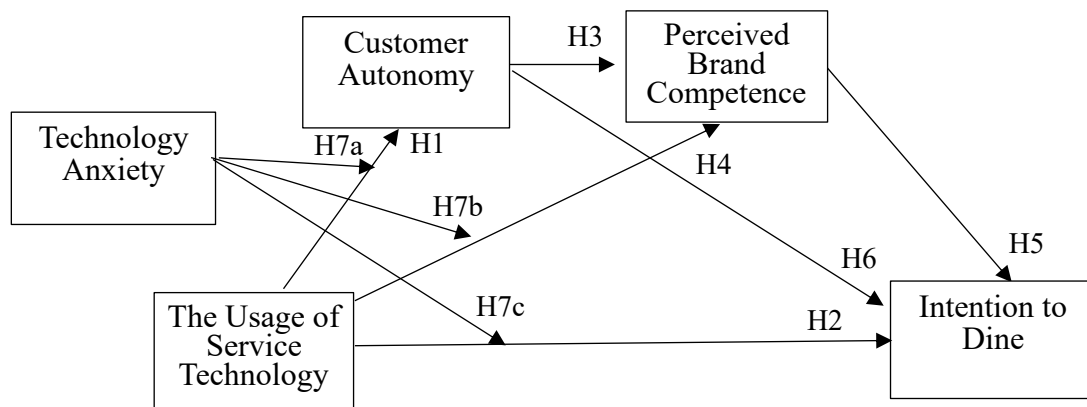


Figure 1 Research Model

3. Research Methodology

3.1 Measurement development

In this study, we employed the survey method to collect data and test the proposed model empirically. All the scale items were initially developed based on prior studies as possible and then adapted to fit the research context of this study. To ensure the readability, a pretest was conducted by inviting 15 undergraduate students with service technology usage experience to provide comments on the questionnaire content and structure and a few questions with ambiguous wording were thus modified. Items were measured using a five-point Likert scale ranging from “strongly disagree” (1) to “strongly agree” (5) was used to measure all items.

3.2 Data collection

This study invited the customers with dining experience at the Kura Sushi restaurant in Taiwan to support our data survey. Kura Sushi restaurant was selected because it is a famous Japanese restaurant and has implemented service technologies to provide low-contact services for customers. The invitation letter for the survey was published in the various social media, such as Line and Instagram. A total of 281 participants joined in the survey.

4. Data Analysis and Results

We used the two-step method to carry out data analysis. In the first step, we analyzed the measurement model to establish reliability and validity of the measures. Then we validated the structural relationships among the latent constructs in the second step. We employed the partial least squares (PLS) approach to evaluate the measurement and structural model. In this study, we conducted data analysis using the software of SmartPLS 4.0 (Ringle et al., 2024).

4.1 Measurement model test

In this study, we conducted tests of reliability, convergent validity, and discriminant validity to assess the adequacy of the measurement model. As shown in Table 1, all the values of cronbach's alpha, composite reliability (ρ_a and ρ_c) are well above the recommended level of 0.70, indicating the adequate reliability. Moreover, as shown in Table 2, the factor loadings are greater than 0.7 and the values of average variance extracted (AVE) exceed 0.5, suggesting the acceptable convergent validity (Fornell and Larcker, 1981). Our results also reveal that all the values of the square root of the AVE exceed the correlation shared between a construct and other constructs in the model (see Table 2), indicating that discriminant validity is adequate (Fornell and Larcker, 1981).

Table 1 Measurement items statistics

Variable	Item	Factor Loading	Cronbach's Alpha	CR (rho_a)	CR (rho_c)	AVE
The Usage of Digital Service (UDC)	UDC1	0.861	0.851	0.862	0.900	0.693
	UDC2	0.757				
	UDC3	0.896				
	UDC4	0.810				
Customer Autonomy (CA)	CA1	0.863	0.893	0.898	0.934	0.825
	CA2	0.928				
	CA3	0.931				
Perceived Brand Competence (PBC)	PBC1	0.824	0.898	0.900	0.925	0.710
	PBC2	0.867				
	PBC3	0.854				
	PBC4	0.850				
	PBC5	0.818				
Intention to Dine (ID)	ID1	0.890	0.912	0.924	0.938	0.790
	ID2	0.907				
	ID3	0.900				
	ID4	0.859				
Technology Anxiety (TA)	TA1	0.874	0.894	0.902	0.934	0.826
	TA2	0.923				
	TA3	0.928				

Table 2 Correlations and the square root of the AVE of latent variables

Variable	The Usage of Digital Service	Customer Autonomy	Perceived Brand Competence	Intention to Dine	Technology Anxiety
The Usage of Digital Service	0.833				
Customer Autonomy	0.653	0.908			
Perceived Brand Competence	0.657	0.696	0.843		
Intention to Dine	0.514	0.559	0.653	0.889	
Technology Anxiety	-0.218	-0.212	-0.257	-0.329	0.909

4.2 Structural model test

We used the bootstrapping resampling method with 5,000 samples to generate t-values to determine the significance of paths in the structural model. As shown in Figure 2, the usage of service technology significantly affects customer autonomy and brand competence ($\beta=0.619, 0.343$; $t=12.885, 5.165$, respectively), supporting H1 and H4. The results also show that customer autonomy and brand competence are the predictors of intention to dine ($\beta=0.189, 0.464$; $t=2.475, 7.104$, respectively), while customer autonomy impacts brand competence positively ($\beta=0.439, t=6.774$). Thus, H3, H5 and H6 are supported. However, the usage of service technologies exerts an insignificant effect on intention to dine ($\beta=0.069, t=1.070$), indicating H2 is not supported.

Furthermore, technology anxiety exerts a significant but negative influence on the linkage between the usage of service technology and customer autonomy ($\beta=-0.136, t=2.247$), whereas it has an insignificant effect on the relationship between the usage of service technology and brand competence ($\beta=-0.055, t=1.241$). Hence, H7a is supported and H7b is not supported. Finally, while our results show that it has a significant and positive influence on the relationship between the usage of service technology on intention to dine ($\beta=0.125, t=2.699$), the result is still contract to our hypothesis. Thus, H7c is not supported.

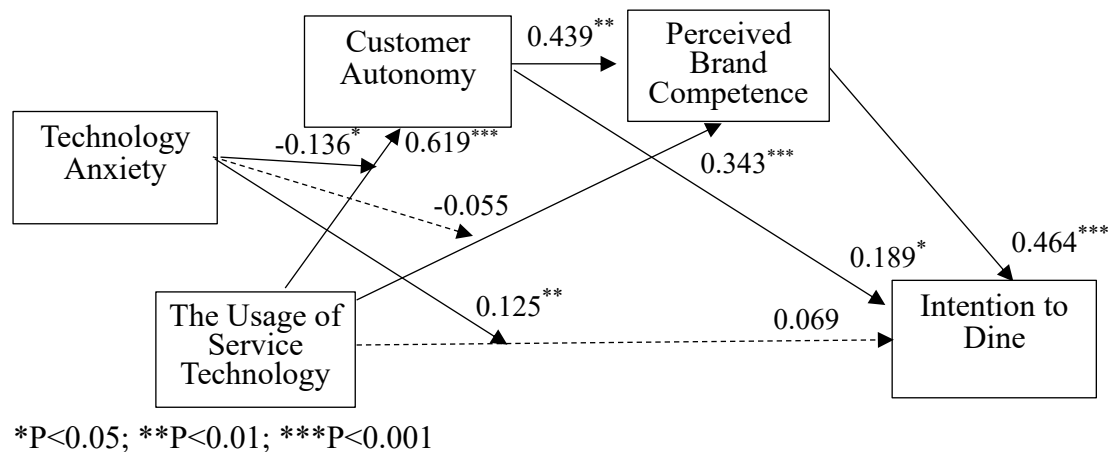


Figure 2 Results of Structural Model Test

5. Discussion

Our results indicate that brand competence and customer autonomy significantly affect the intention to dine in. The findings confirm the perspective of Hwang et al. (2022) that brand competence is a vital predictor of behavioral intention in the restaurant industry. The results also extend past research (e.g., Zhang et al., 2023) by revealing that customer autonomy is the determinant of behavioral intention in the restaurant setting as well. Moreover, our results reveal that the usage of service technologies exerts positive effects on customer autonomy and brand competence. The results confirm the vital role of information technology usage suggested by prior literature (e.g., Hwang et al., 2022). However, the usage of service technology does not have a significant influence on intention to dine. This implies that customer autonomy and brand competence may play a critical mediating role in this study. Further mediation tests also conclude that brand competence and customer autonomy serve as full mediators of the relationship between service technology usage and intention to dine in.

The results of the moderating effect test show that technology anxiety will reduce the impact of the usage of service technology on customer autonomy. This result demonstrates that technology anxiety is the factor mitigating individuals' belief about their ability to use digital service technologies to control order decisions by themselves. Contrary to our expectation, technology anxiety does not have a significant influence on the linkage between service technology usage and brand competence. This finding may imply that implementation of innovative technologies is not an important factor

that enables consumers with high level of technology anxiety to evaluate the competence of a brand. Another surprising finding is that technology anxiety increases the relationship between the usage of service technologies on intention to dine. A possible explanation for this result is that fear or stress of technology usage may act as a positive motivator that could encourage customers to use information technologies to achieve expected outcomes (Nascimento et al., 2024). Further studies could include the aspect of techno-eustress in the model to test its influence. Another explanation for the finding is that some restaurants still provide human services for the customers who are not willing to use service technologies to order meals. Thus, customers with high level of technology anxiety will not worry about the technology usage barriers in these technology-oriented restaurants.

In summary, our study makes several contributions to existing literature. First, this study demonstrates that customer autonomy is a vital mediator that could impact brand competence and intention to dine in the restaurant which has implemented service technologies. Our results also reveal technology anxiety may moderate the influence of service technology usage on customer autonomy. These findings also provide some useful directions for restaurants to deploy strategies to increase customer visit intention by facilitating customer autonomy perception and brand competence.

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The Influence of Green Tourism on Tourists' Green Consumption Behavior on Low-Carbon Islands

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Abstract

As environmentally conscious consumers increasingly express their environmental awareness through purchasing behaviors, green marketing has become more critical than ever. This study aims to investigate whether tourists' personal factors and their perception of green tourism components—such as eco-friendly activities and accommodations at a destination—positively influence their green purchase intentions and behaviors. The research was conducted on a low-carbon island, Xiaoliuqiu, where tourists were invited to complete a face-to-face questionnaire using a judgmental sampling method. A total of 200 valid responses were collected. The findings are as follows: (1) Attitudes toward green products and low-carbon tourism have a significant positive influence on green purchase intention. (2) Attitudes toward green products, low-carbon tourism, and green dining services significantly impact green purchasing behavior, with low-carbon tourism demonstrating the strongest effect. (3) Green purchase intention mediates the relationship between antecedent variables (e.g., attitudes and perceptions) and actual green purchasing behavior. This study contributes to the literature by highlighting that tourists' green purchasing intentions and behaviors on a low-carbon island are not only shaped by their personal attitudes but are more substantially influenced by the island's low-carbon environment and infrastructure. Therefore, tourism operators should place greater emphasis on shaping the island's green image and establishing a comprehensive low-carbon system.

Keywords: Green tourism, green purchase intention, green purchase behavior, attitude toward green product, low-carbon island design

低碳島綠色觀光對遊客綠色消費行為之影響

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摘要

關心環境的消費者開始通過購買表現出環保意識，使得綠色行銷(green marketing)變得越來越重要。因此，本研究目的為：當觀光目的地各種活動、住宿視為組成綠色觀光行程時，遊客個人因素、觀光目的地綠色觀光因素能否產生正面認知，並影響其綠色產品消費意願及行為。本研究在低碳島-小琉球以判斷抽樣法邀請遊客面對面地填答問卷，共收集有效樣本 200 份。分析結果顯示：(1)對綠色產品態度、低碳旅遊對綠色購買意圖具顯著正向影響。(2)綠色產品態度、低碳旅遊、綠色餐飲對綠色購買行為具顯著正向影響，並且低碳旅遊的影響係數最大。(3)綠色購買意圖在前置因素與綠色購買行為間具有中介效果。本研究貢獻在於，深入瞭解遊客在低碳島旅遊時，遊客對綠色產品購買的意圖及行為不僅受到個人態度的影響，島上低碳環境／設施的影響是更為重要的影響因素，故而觀光業者需要更加重視島嶼形象，以及建立完善的低碳機制。

關鍵字：綠色旅遊、綠色購買意圖、綠色購買行為、對綠色產品態度、低碳島設計

1. Introduction

Green consumption behavior is defined as "a series of distinctive consumer behaviors strongly influenced by social, environmental, and economic considerations" (Essiz, Yurteri et al., 2023). When consumers engage in green consumption behavior, they usually avoid purchasing products that harm the environment, even if green products come at a higher cost (Johnstone and Hooper, 2016). This phenomenon corresponds to the social concern triggered by environmental degradation (Emekci, 2019). From this, it can be observed that environmentally concerned consumers begin to express environmental awareness through their purchasing behavior. Ultimately, the increasing attention consumers pay to environmental issues has made green consumption a mainstream and practical tool for companies to position themselves and communicate their competitive strategies (Naciti, 2019), making green marketing increasingly important.

Although consumers have expressed concern about environmental destruction and many have supportive attitudes or cooperative ideas, only 16% take actual action (D'Souza et al., 2023). According to a report by Mintel Market Intelligence Agency (2018), 32% of Australian residents prefer products with eco-friendly packaging, but only 17% are willing to pay a higher price for green products. Moreover, Rahman and Luomala (2021) pointed out that although more than 50% of individuals purchase green brands, only 24% are willing to pay more for products that protect the environment.

Therefore, the purpose of this study is to investigate whether, when various activities and accommodations at a tourism destination are regarded as components of a green tourism itinerary, tourists' personal factors and the green tourism factors of the destination can generate positive perceptions and influence their green purchase intention and behavior.

2. Literature review

2.1. Green purchase response

Green consumption response represents people's intention or actual behavior toward consuming green products. Green consumption reflects customer buying behavior (Ajzen, 1991). For example, Jaiswal and Kant (2018) argue that individuals' green product behaviors indicate their strong emphasis on the reuse and benefits of the natural environment, as well as their avoidance of purchasing environmentally harmful products. Manosuthi et al. (2024) suggest that intention and actual behavior each hold

distinct importance and are not the same. Besides challenging the notion that intention is equivalent to actual behavior, this distinction also reflects that intention is a reliable antecedent of actual behavior (Carneiro et al., 2021). Therefore, in this study, green purchase intention is defined as an individual's willingness to buy green products, while green consumption behavior is defined as the individual's actual purchase of green products.

2.2. Low carbon island travel quality

Tourism quality represents tourists' perceived evaluation of service resources and attitudes throughout the travel process. Chou (2004) investigated tourists' perceptions of group tour service quality and found that tourists emphasized factors such as attraction planning, optional activities, and accommodation arrangements. Lee (2007), focusing on Green Island, identified tourism quality dimensions including natural environment, information services, attraction planning, travel experience, food quality, accommodation quality, and environmental facilities, and found that service quality enhances tourist satisfaction and perceived travel value. Lin et al. (2013) surveyed tourism service quality in Xiaoliuqiu and categorized service quality into three dimensions: natural scenery, tour guides, and accommodation and dining. Moreover, from an image perspective, destination image represents tourists' collective perception of the quality, attributes, and benefits of a destination (Fakeye and Crompton, 1991). Accommodation image reflects tourists' perception of the quality, attributes, and benefits of lodging environments (Dunk, Gillespie, and MacLeod, 2016). Experience activity image denotes the perceived quality, attributes, and benefits of tourism activities offered to visitors (Liang, 2017). Based on previous research findings, this study categorizes low-carbon island tourism quality into two dimensions: low-carbon facility quality and food and beverage quality.

2.3. Attitude toward green product

Intentions originate from others' attitudes, and according to psychological theory, the associated beliefs and values shape people's attitudes, which in turn lead to intentions and behaviors (Fishbein and Ajzen, 1975). Therefore, attitude represents an individual's stable and consistent evaluative response toward a particular product (Zavali and Theodoropoulou, 2017). Bailey et al. (2016) measured green brand attitude using dimensions such as pleasure, liking, and positive/negative cognition. According

to Kim (2011), attitude positively influences green purchase behavior, and environmental attitude is the most influential predictor of purchasing behavior (Paul et al., 2016; Schlegelmilch et al., 1996). Thus, this study defines attitude toward green products as the degree of an individual's long-term consistent support and preference for green products.

2.4. Hypothesis development

Scholars have asserted that tourism quality influences tourist satisfaction and behavioral intentions (Chou, 2004; Lee, 2007; Lin et al., 2013). Lin et al. (2013) investigated the tourism service quality of Xiaoliuqiu and categorized service quality into three dimensions: natural landscape, tour guides, and accommodation and dining. Their findings indicate that service quality significantly affects tourist satisfaction and revisit intentions. Liu et al. (2020) noted that tourists can develop place identity (an emotional response) through a clear and accurate image of a destination; for example, tourists with positive emotional images of a destination tend to develop stronger place attachment. This study hypothesizes that when tourists perceive that attractions, dining, accommodation, and facilities are thoughtfully planned with low-carbon principles, they will regard these as positive quality factors, thereby influencing their green consumption intentions. Additionally, Duong (2022) confirmed that personality traits positively affect green consumption intentions, that attitudes toward green products positively influence green purchase intentions, and that green consumption intentions in turn influence green purchase behavior. Rahman and Luomala (2021) also found that consumers' attitudes toward green products positively impact their purchase intentions.

H1 Low-carbon travel positively influence green purchase intention.

H2 Green food and beverage positively influence green purchase intention.

H3 Attitude toward purchase product positively influence green purchase intention.

H4 Green purchase intention positively influence green purchase behavior.

H5 Green purchase intention plays a mediator between the relationship of antecedents and green purchase behavior.

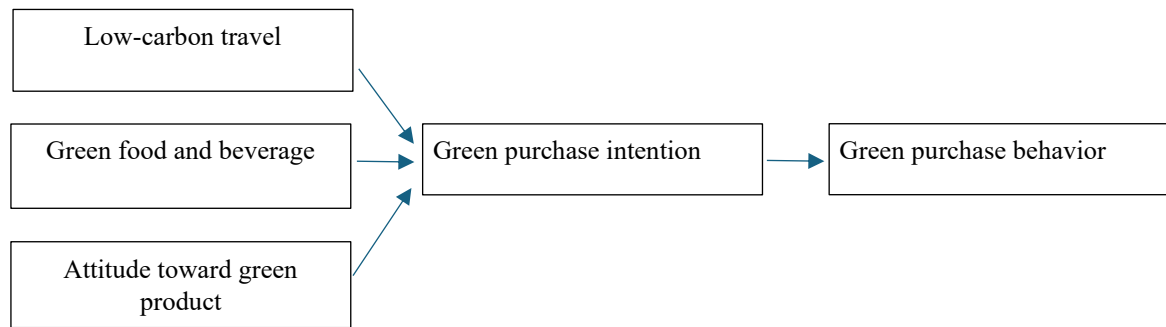


Figure 1 Research framework

3. Research method

The questionnaire used in this study was adapted from both domestic and international research with established reliability and validity. It consists of two main sections: (1) consumers' attitudes toward green products, purchase intentions, and buying behaviors, based on the scales developed by Emekci (2019) and Duong (2022); and (2) perceptions of green tourism quality, adapted from Lin et al. (2013). For sampling, a judgmental sampling method was employed. Data were collected from visitors at Baishawei Wharf in Xiaoliuqiu between September 1 and September 30, 2024. Respondents were approached by the researchers after completing their visit, while waiting to board the return ferry. A total of 200 valid questionnaires were obtained.

4. Statistic results

4.1. Demographic

A total of 200 valid responses were collected for this study. Among the respondents, 37.9% ($n = 75$) were male and 62.1% ($n = 123$) were female. In terms of **marital status**, 53.0% ($n = 106$) were unmarried, 8.5% ($n = 17$) were married without children, 32.0% ($n = 64$) were married with children, and 6.0% ($n = 12$) reported other statuses. Regarding **place of residence**, the majority of respondents lived in the southern region (50.5%, $n = 101$), followed by the central region (25.0%, $n = 50$), northern region (12.0%, $n = 24$), eastern region (6.5%, $n = 13$), outlying islands (1.0%, $n = 2$), and other unspecified areas (3.5%, $n = 7$). In terms of **age distribution**, the largest group was aged 30–39 years (42.5%, $n = 85$), followed by those aged 18–29 years (33.0%, $n = 66$), 40–49 years (16.5%, $n = 33$), below 18 years (4.0%, $n = 8$), 50–59 years (2.5%, $n = 5$), and above 60 years (0.5%, $n = 1$). With regard to **educational background**, 64.5% ($n = 129$) held a university degree, 10.0% ($n = 20$) had a graduate degree, 14.0% ($n = 28$) completed high school, 6.0% ($n = 12$) had a college-level education, and 4.0% ($n = 8$)

had an education level below junior high school. As for **occupation**, the largest group worked in the service industry (32.0%, n = 64), followed by manufacturing (21.0%, n = 42), students (20.5%, n = 41), government officials (9.0%, n = 18), others (8.5%, n = 17), homemakers (4.5%, n = 9), those in agriculture (2.5%, n = 5), and retirees (1.0%, n = 2). In terms of **annual income**, 39.5% (n = 79) reported earning less than NT\$500,000, 30.5% (n = 61) earned between NT\$500,000 and NT\$750,000, 18.0% (n = 36) earned between NT\$751,000 and NT\$1,000,000, 6.0% (n = 12) earned between NT\$1,010,000 and NT\$1,250,000, and 5.0% (n = 10) earned more than NT\$1,250,000.

Table 1 Samples' profile

Gender	No	%	Salary/year	No	%
Male	75		Below than NT\$500,000	79	39.5
Female	123		500K-750K	61	30.5
Marriage	No	%	751K-100K	36	18.0
Not married	106	53.0	NT\$1010K-1250K	12	6.0
Married without child	17	8.5	Above NT\$1.25 million	10	5.0
Married with child	64	32.0	Occupation	No	%
Others	12	6.0	Agriculture	5	2.5
Living area	No	%	Service	64	32.0
North	24	12.0	Manufacture	42	21.0
Central	50	25.0	Government official	18	19.0
South	101	50.5	Homemaker	9	4.5
East	13	6.5	Retire	2	1.0
Outlying islands	2	1.0	Others	17	8.5
Others	7	3.5	Students	41	20.5
Age	No	%	Education	No	%
Below 18 years old	8	4.0	Below junior high school	8	4.0
18-29	66	33.0	High school	28	14.0
30-39	85	42.5	College	12	6.0
40-49	33	16.5	University	129	64.5
50-59	5	2.5	Graduate school	20	10.0
Above 60 years old	1	0.5			

Missing data: 2

4.2. Construct Validity and Reliability

This study employed five constructs, all of which demonstrated high internal consistency, with Cronbach's alpha values exceeding 0.95. The factor structures were validated using exploratory factor analysis (EFA), and all factor loadings were above 0.80, indicating good convergent validity.

Table 2 EFA results of all dimensions

Green Purchase Intention ($\alpha=0.973$) Eigenvalue=2.84; CVE=94.89%	Factor loading
I would consider purchasing green products because they cause less pollution over time.	0.983
For ecological reasons, I would consider switching to environmentally friendly brands.	0.974
I intend to spend more on environmentally friendly products rather than conventional ones.	0.965
Attitudes Toward Green Products ($\alpha=0.981$) Eigenvalue=5.49; CVE=91.58%	Factor loading
I care deeply about environmental protection when making purchasing decisions.	.922
I believe green products help reduce pollution (e.g., water, air, etc.).	.964
I believe green products contribute to the protection of nature and resources.	.964
If given the choice, I would choose green products over traditional ones.	.958
Purchasing green products is a wise choice.	.966
Green products offer many benefits.	.967
Green Consumption Behavior ($\alpha=0.968$) Eigenvalue=5.89; CVE=84.14%	Factor loading
I believe the government should encourage businesses to develop more eco-friendly packaging materials.	.920
I think the government or businesses should promote and educate the public about eco-labeling systems.	.947
Changing consumption habits is worthwhile for human health and sustainable development of the planet.	.954
I actively request that businesses improve environmentally unfriendly practices.	.834
I constantly remind myself that environmental issues are relevant to all forms of consumption.	.947
I accept green alternatives even if they are less functional or more expensive.	.872
I am aware that environmental issues are becoming increasingly serious.	.941

Low-Carbon Island Tourism Quality ($\alpha=0.967$) Eigenvalue=3.64; CVE=91.05%	Factor loading
The island features charming natural ecological attractions.	.956
The island provides convenient electric scooter rentals.	.966
There are many eco-friendly accommodations available on the island.	.968
The island offers a well-developed low-carbon tourism experience.	.926
Green food and beverage quality ($\alpha=0.956$) Eigenvalue=4.27; CVE=85.39%	Factor loading
Meals on the island are mostly prepared using local ingredients.	.933
Hotels on the island do not proactively provide disposable toiletries.	.941
Most restaurants on the island do not provide single-use tableware by default.	.938
Hotels do not change bed sheets and towels for extended stays.	.946
Island restaurants promote portion control and food-saving practices.	.860

CVE: Cumulative Variance Explained

4.3. Hypothesis test

Three hierarchical regression models were conducted to test the hypothesis. In **Model 1**, it analyzed the influence of tourists' attitudes toward green products and perceptions of low-carbon travel and green food and beverage on green purchase intention. The results indicated that both *attitude toward green products* ($\beta = .48$, $t = 8.17$, $p < .001$) and *low-carbon travel* ($\beta = .46$, $t = 5.03$, $p < .001$) significantly and positively affected green purchase intention. However, *the green food and beverage* ($\beta = -.072$, $p > .05$) did not significantly influence green purchase intention. The model explained 69% of the variance (Adjusted $R^2 = .69$, $F = 150.57$, $p < .001$), indicating strong explanatory power.

Table 3 regression results for hypothesis test

Model	Model 1			Model			Model 3		
Dependent variable	Green purchase intention			Green purchase behavior			Green purchase behavior		
Independent variables	β	t	VIF	β	t	VIF	β	t	VIF
Attitude toward green product	.48	8.17***	2.26	.27	5.57***	2.26	.14	2.61**	3.03
Low-carbon travel	.46	5.03***	5.53	.48	6.35***	5.53	.36	4.65***	6.24
Green food and beverage	-.06	-.72	4.58	.20	2.89**	4.58	.22	3.31***	4.59
Green purchase intention							.28	4.93***	3.31
Adjusted R ²	.69			.79			.81		
F	150.57			250.70			216.52		

* $p < .05$, ** $p < .01$, *** $p < .001$

Model 2 examined the direct effects of the same three predictors on green purchase behavior. Attitude toward green products ($\beta = .27$, $t = 5.57$, $p < .001$), low-carbon travel ($\beta = .48$, $t = 6.35$, $p < .001$), and *green food and beverage* ($\beta = .20$, $t = 2.89$, $p < .01$) all had significant positive effects on green purchase behavior. The explanatory power increased to 79% (Adjusted R² = .79, $F = 250.70$, $p < .001$). **Model 3** incorporated green purchase intention as a mediating variable. The results showed that *green purchase intention* ($\beta = .28$, $t = 4.93$, $p < .001$) significantly influenced actual green purchase behavior, while the effects of *attitude toward green products* ($\beta = .14$, $t = 2.61$, $p < .01$), low-carbon travel ($\beta = .36$, $t = 4.65$, $p < .001$), and green food and *beverage* ($\beta = .22$, $t = 3.31$, $p < .001$) remained significant. This suggests that green purchase intention partially mediates the relationship between these antecedents and green purchase behavior. Model 3 achieved the highest explanatory power (Adjusted R² = .81, $F = 216.52$, $p < .001$). These findings underscore the pivotal role of both cognitive (attitudes) and contextual (low-carbon and green service) factors in shaping tourists' green purchasing behaviors, with green purchase intention serving as a key mediating mechanism.

5. Conclusions

This study examined the effects of green tourism quality and personal attitudes on tourists' green purchase intentions and behaviors, using the low-carbon island of Xiaoliuqiu as the empirical setting. Results from multiple regression analysis indicate that both attitude toward green products and low-carbon travel significantly and positively influence green purchase intentions, confirming previous findings that environmental attitude is a key predictor of green purchase intention (Kim, 2011; Paul et al., 2016; Schlegelmilch et al., 1996). Additionally, low-carbon travel exhibits the strongest positive impact on green purchase behavior, highlighting that the low-carbon facilities and service quality provided by the destination are critical drivers for actual green consumption behavior (Lin et al., 2013; Liu et al., 2020).

Furthermore, while green food and beverage quality positively affects green purchase behavior, its influence on purchase intention is not significant. This suggests that environmentally friendly practices in dining services may better facilitate the transition from intention to behavior. These findings support the perspectives of Duong (2022) and Rahman and Luomala (2021), indicating that attitude and tourism quality jointly influence consumers' green behaviors. Importantly, green purchase intention mediates the relationship between antecedent factors and purchase behavior, confirming that intention serves as a crucial bridge to behavior (Carneiro et al., 2021).

Overall, the results emphasize that, beyond personal positive attitudes toward green products, the destination's low-carbon facilities and environmental quality are key factors in promoting tourists' green consumption behaviors. This study suggests that tourism operators should enhance low-carbon tourism environments and green service promotion while strengthening the island's green image to effectively increase tourists' green purchase intentions and actual behaviors, thereby advancing sustainable tourism.

Regarding research limitations and suggestions, this study was conducted in Xiaoliuqiu with purposive sampling, limiting the generalizability of the results. Future research should expand sample size and adopt random sampling to improve representativeness. In addition, this study focused on low-carbon facilities and food and beverage quality, excluding other green tourism elements such as transportation; future studies are encouraged to include more green tourism dimensions. Psychological variables like social norms and personal values were not considered; future research

could incorporate moderating or mediating variables to enrich theoretical insights. Lastly, the cross-sectional design limits the examination of long-term causal effects, and future studies might adopt longitudinal or experimental designs to further explore the sustainability of green consumption behavior.

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Exploring Decentralized ESG in RWA Ecosystem with the Socio-Technical Co-construction Framework

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Abstract

This study investigates the embeddedness of decentralized environmental, social, and governance (dESG) governance mechanisms within Real World Asset (RWA) tokenization platforms, employing the Socio-Technical Co-Construction (STC) framework. Through a comparative case analysis of six platforms—Toucan, Solid World, Flowcarbon, Centrifuge, Goldfinch, and Lofty.ai—this research explores six analytical dimensions: legal mapping, technical execution, compliance handling, governance structure, cross-chain integration, and dESG embeddedness. The research reveals three core findings: (1) platform governance structures and regulatory strategies vary significantly based on asset types and market positioning; (2) dESG is emerging as a critical innovation driver in sustainable finance; and (3) cross-chain interoperability and ESG data standardization remain key bottlenecks. Practical implications are proposed for financial and insurance institutions aiming to participate in the RWA ecosystem. This study contributes theoretically by extending STC to digital governance studies and conceptually framing dESG as institutional infrastructure, offering insights into sustainable blockchain finance.

Keywords: Real World Assets, Tokenization, decentralized ESG, Socio-Technical Co-Construction

1. Introduction

Real World Asset (RWA) tokenization has emerged as a significant trend in financial technology innovation, leveraging blockchain to manage traditionally illiquid assets such as real estate, private equity, carbon credits, bonds, and artworks on-chain. This process enhances liquidity, reduces transaction costs, improves transparency, and facilitates fractional ownership and real-time settlement. The RWA market is projected to reach \$16 trillion by 2030, highlighting its strategic role in bridging decentralized finance (DeFi) with the real economy.

Simultaneously, the rising global emphasis on Environmental, Social, and Governance (ESG) issues has led to the emergence of **Decentralized ESG Governance (dESG)**. Traditional ESG frameworks suffer from information opacity, inconsistent standards, high auditing costs, and a lack of real-time data. dESG aims to redefine sustainable financial governance by leveraging blockchain's transparency, immutability, and smart contract automation. It enhances the verifiability and traceability of ESG information and institutionalizes community participation and sustainable behavior through DAOs and token-based incentives.

Despite the developmental momentum of both RWA and dESG, existing research primarily focuses on their technological mechanisms or individual institutional designs. There is a lack of systematic investigation from the perspective of **Socio-Technical Co-Construction (STC)**, a theory examining the mutual shaping of technology and institutional structures. Specifically, how dESG principles are embedded in platform governance, regulatory compliance, cross-chain integration, and sustainability incentives remains understudied. RWA platforms exhibit diverse institutional strategies for implementing dESG, necessitating in-depth comparative analysis.

This study adopts the STC perspective to examine how six representative RWA platforms integrate dESG elements through comparative case analysis. Research objectives include constructing a socio-technical analytical framework, conducting comparative analysis, identifying innovation challenges and opportunities, and contributing to scholarly and practical discourse on sustainable financial architectures.

2. Literature Review and Theoretical Foundation

2.1 Real World Asset Tokenization (RWA)

RWA tokenization transforms traditional assets into programmable, tradable digital tokens on blockchain. This enhances asset liquidity, reduces transaction costs, improves transparency, and promotes financial inclusion. The market potential is significant, with projections reaching \$16 trillion by 2030, positioning RWA as a crucial bridge between DeFi and the real economy. Challenges include asset verification, compliance mechanisms, and governance frameworks, requiring coordinated technological and regulatory advancements.

2.2 Decentralized ESG Governance (dESG)

ESG is now a core benchmark in capital markets and policy-making, with transparency and verifiability of ESG data becoming key determinants of asset value. Traditional ESG systems face challenges including fragmented standards, reliance on self-disclosure and third-party audits, and high verification costs. **dESG** offers a disruptive alternative by leveraging blockchain's trustless architecture and smart contracts. Core features include transparency and immutability via on-chain storage, decentralized governance through DAOs, token-based incentive mechanisms, and composable architecture for interoperability. Examples include Toucan Protocol for on-chain carbon credits, Solid World for pre-financed carbon credits, and Flowcarbon for regulatory-compliant tokenization. However, dESG faces challenges such as lack of cross-chain data standards, complexity in decentralizing evaluation processes, and ambiguous regulatory frameworks. dESG represents a new institutional logic, transforming ESG verification and accountability into programmable, composable, and governable blockchain protocols.

2.3 Socio-Technical Co-Construction Theory (STC)

STC theory posits that technological systems evolve through continuous interactions and negotiations between technology and institutional structures (laws, regulations, organizations, governance). This framework has been adopted in blockchain studies to explain how decentralized systems co-evolve with regulatory norms and multistakeholder systems. Sustainable operation requires co-design and coordination between institutional design (incentives, governance) and technical architecture (consensus, on-chain logic). Platforms like Toucan and Solid World

exemplify STC, where tokenization (technology) interacts with external standards (Verra) and emergent DAO structures (institution). STC highlights “institutional vacuums” in blockchain, where users must invent rules and trust mechanisms, reinforcing the need for systems to respond dynamically to legal, user, and ecological shifts. Flowcarbon's legal mapping for compliance also embodies STC's attention to both institutional and technical considerations.

2.4 Literature Synthesis and Research Gap

While RWA, decentralized governance, LegalTech, and ESG are important blockchain research areas, there is a lack of systematic comparative and theoretical analysis on integrating dESG into RWA platforms. Studies on carbon tokenization, sustainability incentives, and DAO governance in this context remain preliminary. This study applies the STC framework to address this gap.

3. Research Methodology

This study adopts the Socio-Technical Co-Construction (STC) theory as its core analytical framework, focusing on the dynamic interaction between blockchain technology and institutional environments, specifically for dESG integration within RWA platforms.

3.1 Data Collection

A Qualitative Comparative Analysis (QCA) approach is used, selecting six representative RWA platforms based on diversity-oriented criteria:

Asset Class Diversity: Carbon credits (Toucan, Solid World, Flowcarbon), receivables/SME assets (Centrifuge), credit-based lending (Goldfinch), real estate (Lofty.ai). This allows exploring dESG embedding across different asset types.

Institutional Configuration Variety: DAO-led (Toucan, Solid World), semi-centralized (Flowcarbon), investment committee (Goldfinch), limited-governance (Lofty.ai). This supports comparing decentralization strategies.

Compliance Orientation Spectrum: Explicit regulatory adoption (Flowcarbon, Lofty.ai) vs. community trust (Toucan, Solid World). This helps analyze differing approaches to legal compliance.

Technical Maturity & Innovation: All feature open protocols, modular smart contracts, and DeFi integration.

Field Recognition & Referenced Cases: Platforms referenced in reports or actively discussed in the industry.

Geopolitical & Legal Diversity: Platforms registered in various jurisdictions.

Data sources include whitepapers, regulatory filings, technical documentation, and media reports, organized into a comparative data matrix.

3.2 Six-Dimension Analytical Framework

Grounded in STC theory, this study uses the following seven analytical dimensions to capture the socio-technical configurations of RWA platforms:

Legal Mapping: How platforms align with jurisdictional laws, use SPV structures, and standardize smart contracts for compliance and investor rights. Example: Flowcarbon's dual-SPV structure.

Technical Execution: Analysis of tokenization, smart contracts, and token economic models for security, composability, and scalability. Example: Toucan's standardized carbon tokens.

Compliance Handling: Implementation of KYC/AML and ESG disclosure mechanisms. Example: Solid World combining on-chain verification with third-party auditing.

Governance Structure: DAO design, governance tokens, voting mechanisms, assessing flexibility, engagement, and risk control. Example: Centrifuge's dual-token model.

Cross-Chain Integration: Use of bridges and Layer 2 solutions for asset synchronization and interoperability. Example: Goldfinch integrating Ethereum with sidechains.

dESG Embeddedness: How decentralized sustainability is implemented via carbon management, ESG data verification, incentives, and DAO governance. Example: Toucan's collaboration with KlimaDAO.

These dimensions correspond to STC's interaction layers, providing a systematic framework.

4. Data Analysis: Comparative Case Studies

This section analyzes each platform across the seven dimensions, highlighting their unique socio-technical configurations and dESG integration strategies.

4.1 Toucan Protocol

Toucan Protocol is an open-source carbon market infrastructure on Polygon, tokenizing verified carbon credits into on-chain assets (BCT, NCT). It prioritizes modularity, composability, and decentralization.

Legal Mapping: Operates in a gray zone, positioning as infrastructure; relies on off-chain Verra bridging but requires users to verify credit status, highlighting tension between decentralization and accountability.

Technical Execution: Multi-layer architecture (bridge, pool, registry) standardizes carbon tokens for DeFi, with a DAO-governed "pool filter" for dynamic curation.

Compliance Handling: No protocol-level KYC/AML, emphasizes on-chain transparency; responded to quality concerns by tightening filters and collaborating with assessors.

Governance Structure: Progressing to DAO governance via community voting for filters and grants; currently a hybrid model with core team influence.

Cross-Chain Integration: Deployed on Polygon, integrates with Ethereum DeFi; plans expansion to other chains for liquidity and interoperability.

dESG Embeddedness: Encodes carbon asset flow on-chain, enabling transparent, programmable climate action via KlimaDAO collaboration and incentives; faces challenges with on-chain third-party validation and full ESG compliance.

4.2 Solid World

Solid World is a decentralized pre-financing protocol for carbon projects on Polygon, addressing capital bottlenecks by tokenizing forward carbon credits. It uses a dual-layer token architecture and DeFi mechanisms (AMMs, bonding curves, oracles) for pricing and capital flow.

Legal Mapping: Classifies tokens as utility tokens, avoids financial securities classification; relies on project developer compliance and user risk recognition; explores structured legal wrappers for accountability.

Technical Execution: Manages carbon forward token pools via community/council approval, bonding curves for pricing, and oracles for data updates; uses smart contracts for minting, exchange, vesting, and slashing.

Compliance Handling: Integrates ESG-related compliance via open metadata, on-chain proposals, and encouraging developer certification; transparency of data and funding helps mitigate fraud concerns; exploring ESG data provider partnerships.

Governance Structure: Hybrid model with community voting and council review, balancing participation and expertise; uses SOLD token for voting, staking, and incentives.

Cross-Chain Integration: On Polygon with DeFi integration; plans multichain deployment (Celo, Gnosis Chain) to expand reach; forward token standard designed for cross-chain features.

dESG Embeddedness: Programmable, transparent ESG project evaluation via community review and open data; incentive-compatible mechanisms (slashing, rewards) link liquidity to sustainability outcomes; provides a dynamic, forward-looking view of ESG efforts but faces scaling and interoperability challenges.

4.3 Flowcarbon

Flowcarbon is a U.S.-based, enterprise-first carbon finance platform connecting the voluntary carbon market with on-chain infrastructure, emphasizing regulatory compliance. Its GNT token represents certified carbon offsets. It uses a dual-SPV structure and on-chain trust for legal compliance and asset custody.

Legal Mapping: Fully compliant, registered under U.S. SEC Reg D/S; dual-SPV structure ensures legal claim on underlying assets and prevents double issuance; engages legal counsel for regulatory alignment.

Technical Execution: Dual-token system (GNT for assets, FCO for governance); smart contracts manage custody verification, redemption, and traceability with metadata linking tokens to projects; uses oracles and off-chain attestations.

Compliance Handling: Cornerstone strategy with KYC/AML, jurisdictional restrictions, and only using internationally standardized carbon credits; partners with developers and auditors for verification and retirement; discloses data publicly.

Governance Structure: Centralized initially with founding team/legal advisors; plans progressive decentralization via DAO (FCO token not yet deployed); current model balances decentralization and compliance for institutional onboarding.

Cross-Chain Integration: On Ethereum, plans expansion to EVM-compatible chains; infrastructure built for long-term interoperability and cross-chain ESG verification.

dESG Embeddedness: "Compliance-first" model embedding ESG standards via legally enforceable contracts, on-chain traceability, and audits rather than community curation; enhances regulatory credibility; a bridge between traditional ESG finance and blockchain.

4.4 Centrifuge

Centrifuge is a decentralized asset financing protocol tokenizing RWAs (invoices, receivables) into NFTs for collateral in DeFi lending. It aims to bridge traditional finance with decentralized liquidity for SMEs. Infrastructure includes Tinlake smart contracts and the Centrifuge Chain (Substrate/Polkadot).

Legal Mapping: Structured legal wrapper via off-chain SPVs for asset onboarding and legal ownership; investors hold ERC-20 tokens (DROP/TIN) representing claims; legal agreements define rights/obligations; delegates compliance to SPVs for protocol insulation.

Technical Execution: Dual-layer (NFTs for assets, Credit Pool Layer via Tinlake); NFTs contain asset metadata; pools use smart contracts for funding, risk tranching (DROP/TIN), repayment, and distribution; architecture supports diversification, efficiency, and composability; Centrifuge Chain adds cross-chain, staking, and identity modules.

Compliance Handling: Hybrid model with off-chain originator KYC/AML and credit risk assessment; investor eligibility based on jurisdiction (e.g., Reg D); transparency via public dashboards; third-party audits of asset structures; combination of on-chain automation and off-chain accountability.

Governance Structure: Dual-token (CFG for protocol governance, DROP/TIN for pool risk alignment); CFG holders vote on parameters, funding, pool approvals;

delegated voting and quadratic mechanics; Centrifuge DAO for progressive decentralization.

Cross-Chain Integration: Deployed on Ethereum and Polkadot with bridges connecting Tinline and Centrifuge Chain; seamless transfer of NFTs/assets; integrates with MakerDAO/Aave; plans Cosmos/Avalanche integration.

dESG Embeddedness: Not ESG-first, but incorporates dESG via asset onboarding and transparency; some pools focus on sustainable finance/impact lending; governance supports community evaluation of ESG metrics; exploring ESG data provider integration; transparent, auditable flows indirectly strengthen dESG, especially in SME lending.

4.5 Goldfinch

Goldfinch is a decentralized credit protocol focusing on under-collateralized real-world lending in developing markets. It addresses the "missing middle" by enabling loans based on off-chain credit assessment and trust networks without crypto collateral. Uses liquidity pools (Senior Pool, Backer Pools) and community-driven reputation models.

Legal Mapping: Uses off-chain entities (Borrower SPVs) for legal loan agreements enforceable locally; protocol is non-custodial; complies with Reg D/S for U.S. investors; legal hybrid design provides regulatory clarity while preserving decentralized allocation.

Technical Execution: Dual-pool structure (passive Senior Pool, curated Backer Pools); borrowers submit off-chain docs for review; smart contracts automate repayment, interest, tracking; features include epoch cycles, stablecoin integration, auto-rebalancing, and borrower scorecards/dashboards.

Compliance Handling: KYC/AML for borrower SPVs; investor eligibility restrictions; third-party due diligence; risk mitigation via staking, covenants, reserve pools; public reporting tools disclose performance; aligns with financial compliance principles.

Governance Structure: GFI token for voting, staking, grants; progressive decentralization roadmap shifting control to DAO; GFI holders vote on fees, policies, incentives; "Goldfinch Citizens" reputation system supports identity/trust.

Cross-Chain Integration: On Ethereum with LayerZero/Wormhole bridges; plans expansion to EVM-compatible chains for regional deployments; anticipates integration with stablecoins and cross-border payments.

dESG Embeddedness: Contributes to ESG via financial inclusion, SME empowerment, sustainable development; borrower metadata includes optional ESG fields; collaborates with lenders on education, healthcare, climate adaptation projects; demonstrates DeFi lending can support dESG through transparency and programmable credit; potential for integrating verifiable ESG reporting.

4.6 Lofty.ai

Lofty.ai is a U.S.-based real estate tokenization platform on Algorand, enabling fractional property investment via compliant digital securities. Each property is represented by tokens granting proportional ownership and income rights. Leverages AI for selection and blockchain for management, with daily payouts and investor voting rights.

Legal Mapping: Fully regulated framework; properties held by LLCs, token holders are beneficial owners via digital membership interests; issuance under SEC Reg CF/D; legal documents and KYC/AML enforced.

Technical Execution: Uses Algorand ASA for tokenization with legal/financial/governance metadata; daily rental distributions via smart contracts; property data updated on-chain; supports secondary trading; smart contracts manage collections, distributions, voting; AI for property scoring.

Compliance Handling: Core pillar with KYC/identity verification for all investors; SEC compliance status disclosed per property; collaborates with licensed entities for capital flow; U.S. operations provide tax/accounting clarity; regular disclosure of financials and governance updates.

Governance Structure: Property-level system where token holders vote on decisions (rent, repairs, management); voting proportional to holdings; semi-decentralized model combining platform oversight with community input; not a DAO, but introduces practical governance flexibility.

Cross-Chain Integration: Exclusively on Algorand currently; no multichain plans but potential exploration of Layer 2/DeFi integration for capital efficiency; uses stablecoins and bank integration; token transfers permissioned for compliance.

dESG Embeddedness: Supports dESG values (decentralized governance, transparency, financial inclusion); democratizes property access and community ownership; transparent decision-making and reporting; lacks standardized ESG scoring but framework allows future integration of sustainability metrics (energy efficiency, social impact).

5. Conclusion and Suggestions

5.1 Research Conclusions

Applying the STC framework to six RWA platforms across six dimensions reveals four key conclusions:

Institutional configurations vary: Platform architecture reflects strategic differences based on market/asset types, ranging from enterprise-focused compliant models to community-driven decentralized governance.

dESG is a foundational design driver: Platforms embed ESG principles into protocol operations (carbon assets, on-chain disclosures, incentives), enhancing transparency and legitimacy.

Governance and compliance are challenges: Decentralized governance faces voter apathy/control issues, while regulatory fragmentation increases complexity for cross-border applications.

Cross-chain infrastructure and data standardization are critical: Interoperability and standardized ESG data/verification are needed for scalability and resilience.

5.2 Practical Implications

Institutional design should balance governance flexibility and legal robustness, combining SPVs for legal separation with modular smart contracts.

Embedding dESG into protocol logic (standardized disclosures, carbon offsets, sustainability incentives) strengthens credibility and attracts institutional capital.

Prioritize cross-chain compatibility (LayerZero, Axelar) and engage with standard-setting bodies (IWA, Regen Alliance) for open, verifiable ESG data formats.

Guidance for financial and insurance institutions: Assess regulatory compatibility, conduct technical/risk due diligence (on-chain data integration), define governance roles (underwriters, trust anchors), embed dESG into offerings, and collaborate on standards/interoperability. These actors can evolve from passive investors to active enablers of programmable, auditable, compliant digital asset markets.

5.3 Academic Contributions

This study makes multiple contributions:

First application of the STC framework to RWA platforms integrating dESG, illuminating socio-technical co-evolution in blockchain.

Develops a six-dimension comparative framework applied to six diverse platforms, offering a typology of institutional configurations (enterprise-oriented, community-driven, hybrid-flexible).

Reconceptualizes dESG as an institutional innovation—programmable, composable, auditable—enabling distributed accountability and value alignment in DeFi.

5.4 Future Research Directions

Advance dESG standardization and regulatory coordination globally.

Explore resilient and adaptive DAO governance models, possibly through adaptive governance indices.

Expand into novel RWA and ESG-linked assets (SDG assets, green bonds, impact tokens).

Integrate AI and IoT for automated, real-time, credible on-chain ESG data verification.

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The Influence of Consumers' Perceived Residual Value and Perceived Value on Purchase Intention: A Case Study of Second-Hand Luxury Bags

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Abstract

In the post-pandemic society, people's demand for material goods continues to rise. Given economic constraints, the second-hand luxury market is increasingly becoming the preferred choice for consumers. This study takes second-hand luxury bags as an example to develop a research framework that explores the causal relationships between Generation Z student consumers' fashion consciousness, perceived residual value, perceived risk, perceived value, and their purchase intention for second-hand luxury bags.

Using a snowball purposive sampling method, the study targeted Generation Z college students attending schools in western Taiwan. A total of 352 valid responses were collected through an online questionnaire. Data were analyzed using SPSS 26 and SmartPLS 3 software. The results show:

Fashion consciousness, perceived residual value, and perceived value all have a significant positive effect on purchase intention, while perceived risk does not have a significant effect

Perceived residual value partially mediates the relationship between fashion consciousness and purchase intention

Perceived value also partially mediates the relationship between fashion consciousness and purchase intention.

Keywords: Second-hand Luxury Bags, Fashion Consciousness, Perceived Residual Value, Perceived Value, Purchase Intention

1. Introduction

1.1 Research Background and Motivation

“Luxury brands” are shorthand for “famous” and “well-known brands” ^[1]. Many renowned brands such as Hermès, Louis Vuitton, and Chanel fall into the category of high-end luxury labels. The high-end luxury market has remained consistently robust and stable over time. Consumers not only focus on the symbolic meaning of these brands but also view them as expressions of identity and past ^{[2][3]}. However, in the second half of 2023, the luxury brand industry began experiencing a significant drop in demand, leading to slowed sales and unstable performance. Due to the impact of the COVID-19 pandemic and economic downturns, major luxury brands also faced rising prices and raw material costs, which forced them to raise product prices. These high prices have limited the purchasing power of some consumers, prompting them to turn to second-hand luxury goods instead. This shift has contributed to the rapid rise of the second-hand luxury market ^[4]. The second-hand luxury market is projected to reach a value of USD 14.7 billion by 2027, including products such as luxury clothing, footwear, and fashion accessories like bags, watches, and jewelry ^[5]. In Taiwan, data from 2023 shows that “bags” accounted for the highest transaction volume among second-hand luxury products, making up 78% of the total transaction value. Among those purchasing second-hand luxury goods, women outnumbered men, comprising about 80% of buyers^[6]. Additionally, a survey by The RealReal ^[7] pointed out that the core consumers of the second-hand luxury market are members of Generation Z. This younger generation values quality of life and bases their purchasing decisions on cost-performance (value for money). Despite facing pressures from living expenses, they are still willing to invest in material and entertainment-related needs that fulfill psychological or emotional satisfaction. This indicates a shift in young consumers' values: compared to the past, they place greater emphasis on “product value” and “cost-performance” ^{[8][9]}. This shift brings limitless potential for the development of the second-hand luxury market.

Today, the flourishing of the second-hand market not only embodies the principles of a circular economy but also highlights consumers' growing concern for the overall condition of products. The second-hand trading platform Carousell ^[10] noted that the key drivers behind consumers' willingness to purchase second-hand products are “great value for money and still in good condition.” Even if a product has been previously

used, consumers believe that if it has been well maintained, the gap in usability between it and a new product is not significant. For example, in the used car market, the concept of “depreciation rate” is a commonly accepted evaluation standard — the lower the depreciation, the less wear-and-tear, which makes consumers more willing to purchase the vehicle due to its better condition ^{[11][12]}. Notably, while depreciation rate is a familiar concept in the used car market, consumer acceptance and evaluation standards regarding depreciation of second-hand luxury bags appear to be less clearly defined. Perhaps it can be said that in the fashion industry, a concept akin to depreciation rate has yet to be effectively utilized. Depreciation rate, simply put, is a comprehensive market evaluation of a product’s depreciation and pricing — it’s an objective method for assessing product value. For consumers, the most intuitive way to assess product value is to observe the condition of the product after depreciation. Previous studies have mostly focused on how the residual value of second-hand products negatively impacts purchase intention, suggesting that consumers’ perceptions of a product’s residual value generally lead to lower willingness to buy ^[13]. This study, however, proposes that under the halo of a “luxury brand,” consumers’ perception of residual value could instead become a positive cognition — they may believe that the product’s value does not significantly diminish with depreciation. Rather, the product may retain its residual value due to brand-associated qualities such as reputation, trendy design, and durability, all of which continue to attract consumers ^{[14][15]}.

As the saying goes, “you win some, you lose some.” When consumers shop for second-hand products with the intention of saving money, the lower and more attractive prices can also cause them to overlook various potential issues. Nowadays, second-hand luxury trading platforms have become increasingly diverse — from Facebook groups to dedicated second-hand marketplaces — offering convenient channels for consumers to buy and sell luxury bags. While this fosters the market’s growth, it also increases the risk of potential problems. Risks of purchasing second-hand luxury items include poor product quality, dishonest sellers, lack of authenticity, and absence of after-sales service. Among these, quality issues are the most common — any item that has been idle or used over time is likely to experience wear and deterioration. To avoid such unexpected risks, consumers may carefully deliberate before making a purchase, potentially deciding against it altogether. Therefore, understanding perceived risk and reducing the likelihood of such negative outcomes is key to enhancing consumers’

willingness to purchase ^{[16][17]}.

This study uses second-hand luxury bags as a case and approaches the issue from the perspective of Generation Z student consumers, aiming to understand whether residual value still exists in their minds and whether it influences their willingness to purchase. What Generation Z values — “great value” and “cost-performance” — ultimately stems from their personal perception of value. When consumers must invest extra time, effort, or money to acquire a desired second-hand luxury bag, the product they receive and its overall evaluation become the decisive factors in their purchase. Since consumers are value-driven, providing the value they seek is also regarded as a strategy for building competitive advantage in the market ^{[18][19]}. Based on this, the study will treat perceived value and the perceived residual depreciation value as mediating variables. Additionally, it introduces fashion consciousness and perceived risk as independent variables, and finally analyzes the relationships among these variables and purchase intention. The conclusions will summarize appropriate management recommendations to promote the development of the second-hand luxury bag market and assist businesses in adjusting their marketing strategies to meet consumer expectations.

1.2 Research Objectives

This study conducts a survey targeting Generation Z student consumers from various demographic backgrounds, and by examining the relationships among key variables, explores how to enhance the purchase intention of second-hand luxury bags. Ultimately, it aims to offer academic researchers and the second-hand luxury goods industry practical recommendations and strategies. The research objectives are as follows:

To analyze consumers’ demographic backgrounds and purchase experiences.

To explore the causal relationships between variables such as fashion consciousness, perceived depreciation, perceived risk, and perceived value on consumers’ purchase intention toward second-hand luxury bags.

2. Literature Review

2.1 Brand Names

A brand represents consumers’ perception and expectations of a product and its performance—essentially, the overall meaning a product or service holds for

consumers. It is also a critical element in marketing, aimed at creating a unique identity for a product or service to stand out in the market^[20]. Adolescents often purchase “brand-name” products primarily for their logos and trademarks. Many are drawn to expensive, branded items because of the social status they confer, and such products are generally seen as helping individuals achieve their aspirations and desires more easily than those who do not wear branded products^[21].

As of now, there is no universally accepted definition of “brand-name” on an international level. From a sociological perspective, brand names are not solely valuable for their economic function in sales but also carry symbolic social attributes such as identity, status, taste, and social class. The refined quality of brand-name products forms the foundation of sensory pleasure^[22]. Previous studies have typically used the term “luxury goods” to represent brand-name products. However, in recent years, scholars have argued for a more detailed distinction: luxury goods emphasize symbolic meaning and prestige value, providing consumers with intangible satisfaction such as status and a sense of honor, and often carry strong cultural symbolism. In contrast, premium products focus more on design and functional value, appealing to consumers who appreciate quality and aesthetics. Premium products tend to attract consumers through superior craftsmanship and practical utility^{[23][24]}.

In general, luxury and premium products share similar attributes and are generally considered part of the “brand-name” category. Across different times and contexts, people’s understanding of these two categories often overlaps^[25]. Many studies have identified common standards or symbols in the interpretation of brand names across generations and industries. These symbols—such as brand value, quality, craftsmanship, design, and history—are widely recognized by the public as important markers of brand names^{[26][27][14]}.

This study aims to explore college students' purchase intentions for second-hand brand-name products, encompassing both premium and luxury categories. The research focuses on the general perception and behavior related to brand-name products without further subdividing the types.

2.2 Fashion Consciousness

Nam et al.^[28] describe fashion consciousness as an individual's attitude toward fashion—specifically, the collective desire and demand for particular trends, styles, and aesthetics, or one's personal view of fashion phenomena^[29]. Brand consciousness refers

to a shopping orientation that captures the extent to which consumers are enthusiastic about well-known brands when purchasing products or services^{[30][31]}. People are increasingly aware of product brands. According to Clark et al.^[32], fashion-conscious consumers primarily focus on brand logos when purchasing products, and an increasing number of consumers are interested in the latest trends. These consumers are also becoming more selective in their brand choices and increasingly fascinated by well-known brands^{[20][33]}. Based on these studies, this study views fashion consciousness and brand consciousness as inherently coexisting; therefore, brand consciousness is incorporated into the analysis of fashion consciousness.

In a study by Lai et al.^[34], the dimensions of fashion consciousness included a preference for trendy and novel things, attentiveness to fashion trends, interest in new products, and a desire for innovative items. Lin & Lin^[35], in their study of student sneaker purchasing behavior, measured fashion consciousness by the number of new products, whether the products align with current trends, purchase behavior, and attitudes toward fashion. Lee^[36] assessed brand consciousness based on consumers' perceptions of brand-name products, including their liking of such products and the belief that people who choose to buy brand-name items are more discerning.

Talaat^[37] studied young consumers in Egypt and found that their engagement with fashion and purchase intentions were positively influenced by fashion consciousness. Similarly, Jaravaza et al.^[38] found that wealthy consumers in Zimbabwe demonstrated a strong preference for purchasing brand-name beauty products due to the brands' high reputations, confirming a significant positive relationship between brand consciousness and purchase intention.

Based on these studies, we propose the following hypothesis:

H1: Fashion consciousness has a significant positive impact on purchase intention for second-hand brand-name products.

2.3 Perceived Depreciation Value

Depreciation typically refers to the residual value of a product or service after wear and over time. From an economic perspective, the value of an item decreases due to normal wear and tear during use. Other factors affecting depreciation include poor condition, damage, malfunction, consumer perception, and high expectations^{[39][40]}. Shilling^[41] pointed out that perceived depreciation is the change in a product's value as

subjectively recognized by consumers based on their perception of the product's condition. When the change in a product's value arises from consumers' altered perceptions of the product's condition or characteristics, this is considered perceived depreciation^[13].

Previous research mostly explored the negative impact of perceived depreciation on purchase intention, incorporating various tangible damages and intangible value losses into survey items to measure how much consumers care about and are influenced by a product's depreciation state^[42]. However, the market characteristics of second-hand luxury bags differ from other second-hand products. Consumers often have higher expectations for the depreciation state of these items because of factors such as brand reputation, iconic design, and durability. As a result, even though these bags are used and considered second-hand, they still retain a certain appeal, and consumers continue to recognize their value^{[14][43]}. Tu et al.^[44] also evaluated consumers' positive perceptions of second-hand luxury leather goods by considering product quality, personal needs (such as self-expression), and product lifecycle (durability, timelessness).

Therefore, this study argues that perceived depreciation not only reflects the value changes brought about by a product's depreciation state but also emphasizes the positive expectations and evaluations consumers hold when encountering such depreciation. In this study on purchase intention for second-hand luxury bags, perceived depreciation will be treated as a key variable reflecting positive consumer perception, rather than a traditionally negative one.

McNeill and Moore^[45] indicated that consumers who are more sensitive to fashion trends tend to have a deeper understanding of brands and a stronger ability to evaluate value. This enables them to more comprehensively assess product value. These consumers are less fixated on a product's "brand-new" condition and instead place more importance on its design philosophy, craftsmanship, and the cultural significance the brand represents. Smith and Winterich^[46] also found that when a fashion item's design incorporates trendy and fashionable elements, its fashion lifecycle can be extended, reinforcing positive consumer perceptions of depreciation and enhancing purchase intention.

Sun et al.^[43] noted that luxury products are perceived as high-value items due to their superior durability and iconic designs. Even when these products become second-hand, their attributes continue to attract consumer purchases. Stolz^[14] also found that even when luxury products show signs of depreciation, consumers are still willing to purchase them because of factors such as affordability, the brand's high quality, and its status symbolism.

Based on these studies, we propose the following hypotheses:

H2: Fashion consciousness has a significant positive impact on perceived depreciation value.

H3: Perceived depreciation value has a significant positive impact on the purchase intention of second-hand luxury goods.

H4: Perceived depreciation value mediates the relationship between fashion consciousness and the purchase intention of second-hand luxury goods.

2.4 Perceived Value

As one of the most common concepts in social sciences, the notion of value carries different meanings across disciplines. In marketing, the concept of value is seen as a key factor for understanding and predicting consumer behavior^[47]. Wang et al.^[48] defined perceived value as the overall evaluation experienced by consumers when comparing the benefits they receive from purchasing a product with the costs they incur.

Hsieh^[49] suggested that higher perceived value helps enhance consumers' purchase intentions. Moreover, perceived value is a critical determinant of whether consumers will purchase a product.

In their study on the purchase intention of second-hand luxury leather goods, Tu et al.^[44] measured consumers' perceived value by assessing their strong sense of value for luxury brands. Specifically, they focused on the perceived value gap between second-hand luxury goods and brand-new, non-luxury products. Their items included aspects such as high perceived quality, high brand recognition, and high value retention for luxury brands.

Hernandez Fernandez and Lewis^[50], building on Rajh's^[51] perceived value scale, proposed five measurement items:

I think this brand offers high value for money.

Given this brand's price, I think it is a worthwhile purchase.

I think buying products from this brand is a good decision.

Considering the quality of this brand, I think its pricing is reasonable.

I believe the brand's price aligns with its value.

Consumers who are highly attuned to fashion trends tend to place greater importance on a product's brand and design, making them more likely to give positive evaluations to luxury^{[32][20]}. Chen et al.^[52] noted that a brand's value encompasses product design, functionality, marketing activities, and brand reputation, all of which can effectively enhance consumers' purchase intentions for brand products.

Kautish and Sharma^[53] found that when consumers purchase fashion retail products online, their fashion consciousness and perceived value both have a positive impact on purchase intention. Salem and Alanadoly^[54] also found that consumers who are highly involved in fashion trends and have extensive online shopping experience perceive higher value in online fashion products, which further promotes their purchasing behavior.

Based on these studies, we propose the following hypotheses:

H5: Fashion consciousness has a significant positive impact on perceived value.

H6: Perceived value has a significant positive impact on the purchase intention of second-hand luxury goods.

H7: Perceived value mediates the relationship between fashion consciousness and the purchase intention of second-hand luxury goods.

2.5 Perceived Risk

The concept of Perceived Risk was introduced by Bauer in 1960 into the field of marketing management. It refers to the uncertainty that consumers anticipate regarding outcomes before making a purchase decision. Risk exists even in the purchase of regular products, let alone in second-hand products that have been used by others. If the product is a luxury brand, consumers become even more concerned about risk^[55]. Garretson and Clow^[56] pointed out that perceived risk refers to the various risks consumers expect to encounter during the shopping process. The higher the perceived risk, the more likely it will negatively impact the consumer's purchase behavior.

Alexandra and Carchia^[16], as well as Lou et al.^[57], classified the perceived risks associated with purchasing second-hand luxury goods into four categories:

Counterfeit Risk : In the context of second-hand luxury goods, counterfeits are considered the most significant risk. If a consumer purchases a counterfeit product, it may lead to financial and reputational issues^[58].

Quality Risk: The fact that a second-hand luxury product has been used by someone else raises doubts about its quality, which can hinder purchase intention and increase concerns about the market^{[59][60]}.

Seller Dishonesty : With the rise of counterfeits and replicas in the luxury market, consumers are increasingly doubtful about product authenticity. If a consumer purchases an item that differs from the description, it may negatively affect the seller's reputation and customer^{[16][57]}.

Time Risk : Since the prices of second-hand luxury goods vary across the market, it takes time for consumers to compare different sellers and make a choice. If they are dissatisfied with a product after purchase, it also takes time to process returns or refunds^[57].

Sweeney et al.^[19] and Lee Chi-Hoon^[36] both pointed out that the lower the consumer's perceived risk, the higher the perceived value and purchase intention, and that perceived value has a mediating effect between risk and purchase intention. Kessous and Valette-Florence^[55] found that buyers of second-hand luxury goods are mostly price-conscious and prone to doubts about product authenticity, which leads to hesitation in purchasing. If the quality or condition of the second-hand product is poor, consumers will feel the risk, which in turn reduces purchase intention^[59].

Based on these studies, we propose the following hypotheses:

H8: Perceived risk has a significant negative effect on purchase intention for second-hand luxury goods.

H9: Perceived risk has a significant negative effect on perceived value.

H10: Perceived value mediates the relationship between perceived risk and purchase intention for second-hand luxury goods.

2.6 Purchase Intention

Visentin et al.^[61] defined Purchase Intention as the likelihood that a consumer consciously considers buying a product. The higher the consumer's perceived value of a product, the higher the purchase likelihood. When a consumer holds a favorable impression of a product or brand, purchase intention may form^[33]. Any product-related information, such as price (promotions), brand, packaging design, or color, may influence purchase intention^[62].

Lin et al.^[63] measured the influence of different types of brand extension products on brand equity, brand attitude, evaluation of brand extension effectiveness, and purchase intention. The study used the impact of luxury brand products themselves to assess the strength of consumers' purchase intentions. Visentin et al.^[61] developed a questionnaire scale based on three dimensions—recommendation to others, personal opinion of the product, and willingness to take action—to measure the level of consumers' purchase intentions.

Herjanto et al.^[64] explored the impact of two types of past experiences (everyday use situations, specific use situations) and attitudes (hygiene of second-hand clothing, fashion style of second-hand clothing) on the purchase intention for second-hand clothing among Generation Z consumers. The study found that both types of past experiences and attitudes significantly increase consumers' purchase intention for second-hand clothing.

Park and Choo^[47] examined the fashion coordination behavior of Korean college students. The results revealed that the higher a consumer's confidence in their fashion coordination, the more positive their attitude toward second-hand fashion products; however, this confidence did not directly affect purchase intention. On the other hand, a more positive attitude toward second-hand fashion products was associated with a higher purchase intention.

3. Research Methodology

3.1 Research Framework

This study uses fashion consciousness and perceived risk as independent variables; perceived value and perceived residual value as mediating variables; and purchase intention as the dependent variable. It aims to understand consumers' purchase intentions toward second-hand luxury bags and explores the causal relationships between research variables. The research framework is illustrated in

Figure 1.

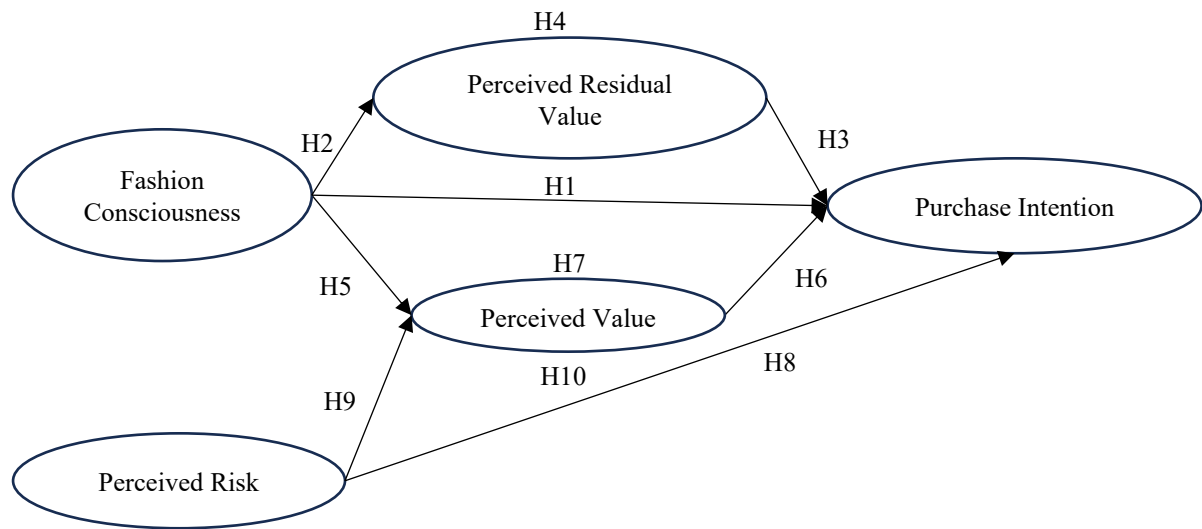


Figure 1. Research Framework

3.2 Operational Definitions

The demographic data collected in this study are divided into "personal background," "awareness and understanding of luxury brands," and "consumption behavior of luxury and second-hand fashion products." The research variables in the questionnaire include five parts: "fashion consciousness," "perceived residual value," "perceived value," "perceived risk," and "purchase intention." All items are measured using a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating greater agreement with the statement.

3.2.1 Basic Information

The personal background information collected includes gender, place of residence, age, academic year, institution and field of study, part-time job status, and average monthly disposable allowance. Luxury brand awareness is measured through:

Familiarity with luxury brands: Participants select the brands they recognize from a list of well-known names. The total number selected is scored, and the familiarity level is divided into high, medium, and low groups using Kelly's^[65] method based on the 27% and 73% normal distribution cutoffs.

Self-assessed understanding of luxury brands: Participants rate their level of understanding based on personal perception. "Very familiar" and "familiar" are categorized as high, "moderate" as medium, and "not familiar" and "very unfamiliar" as low.

Consumption behavior data includes:

Experience with purchasing second-hand fashion items and the types of products bought;

Experience with purchasing luxury fashion products and the types of products bought.

This helps the study better understand consumer habits and preferences.

3.2.2 Fashion Consciousness

Based on the definitions by Nam et al. (2007), Walsh et al. (2017), and Shim & Gehrt (1996), along with Clark et al. (2017)'s assertion that fashion-conscious consumers are also brand-conscious, fashion consciousness is defined as:

"Consumers' internal pursuit of fashion trends and their recognition of luxury products as the best way to express themselves."

The scale is adapted from Lin & Lin^[35] and Lee^[36] and includes 8 items.

Table 1. Fashion Consciousness Measurement Scale

Variable	Dimension	Item
Fashion Consciousness	Fashion	1. I pay attention to current fashion trends.
		2. I change my clothing style according to changes in fashion trends.
		3. I own at least one piece of the latest fashion clothing.
		4. To me, fashionable and trendy clothing is important.
	Brand	5. I learn about current fashion trends through various means (shopping, browsing fashion e-commerce sites, following celebrity outfits, or reading social media or magazine articles).
		6. Wearing brand-name products makes it easier to attract attention from others.
		7. I believe that people who wear or use brand-name products usually have a high sensitivity to fashion.
		8. I pay attention to information related to well-known brands.

3.2.3 Perceived Residual Value

Based on Stolz^[14], Sun et al.^[43], Shilling^[41], and Chang^[42], perceived residual value is defined as:

"Consumers' positive value assessment based on subjective perception of the remaining characteristics of second-hand luxury items despite depreciation."

The scale is adapted from Chang et al.^[42] and Tu et al.^[44], with a total of 7 items.

Table 2. Perceived Residual Value of Depreciation Measurement Scale

Variable	Item
Perceived Residual Value of Depreciation	1. I believe that even as second-hand items, second-hand luxury bags generally have good overall quality (material, craftsmanship, design).
	2. At the same price point, I think the craftsmanship, design, quality, and durability of second-hand luxury bags are not inferior to brand-new bags from regular brands.
	3. Although they are second-hand, I believe second-hand luxury bags can still have a long usable lifespan.
	4. I think luxury products are highly durable; even second-hand luxury bags can meet all my needs.
	5. I believe luxury products have high brand value. Even second-hand luxury bags can demonstrate uniqueness and fulfill my needs.
	6. I think the design of second-hand luxury bags is classic and timeless.
	7. I believe that, as long as the style is well matched, even second-hand luxury bags can still express my personal style.

3.2.4 Perceived Value

Following the definitions by Wang et al.^[48] and Shieh^[49], perceived value is defined as:

"Consumers' overall evaluation after comparing the benefits received with the costs paid during a purchase; higher perceived value enhances purchase intention."

The scale is adapted from Hernandez Fernandez & Lewis^[50] and Tu et al.^[44], and consists of 7 items.

Table 3. Perceived Value Measurement Scale

Variable	Item
Perceived Value	1. I believe that second-hand luxury bags offer a high cost-performance ratio (value for money).
	2. Considering the originally high price of luxury goods, I think buying second-hand luxury bags is a good deal.
	3. I think buying second-hand luxury bags provides great value for the money.
	4. Given the quality of world-renowned brands, I think it is reasonable for second-hand luxury bags to be priced slightly higher.
	5. I believe second-hand luxury bags are more worth owning than bags from regular brands.
	6. The quality of second-hand luxury bags is better than that of bags from regular brands.
	7. Second-hand luxury bags are more distinctive than bags from regular brands.

3.2.5 Perceived Risk

Following Garretson & Clow^[56], perceived risk is defined as:

"Consumers' anticipation of various risks during the shopping process. When these perceived risks are high, they negatively impact purchase intention."

The scale is adapted from Lou et al.^[57] and includes 5 items.

Table 4. Perceived Risk Measurement Scale

Variable	Item
Perceived Risk	1. I think it is difficult to verify the authenticity of a second-hand luxury bag when making a purchase.
	2. If I am dissatisfied with the second-hand luxury bag I purchased, I might not be able to exchange or return it.
	3. Since the quality and price of second-hand luxury bags vary by seller, I need to spend more time comparing information from different sources.
	4. Compared to retailers of brand-new luxury bags, it is harder to find trustworthy sellers of second-hand luxury bags.
	5. When buying second-hand luxury bags online, the product information or photos may not match the actual item received.

3.2.6 Purchase Intention

According to Shah et al.^[33] and Visentin et al.^[61], purchase intention is defined as:

"Consumers' psychological tendency to buy second-hand luxury bags when they have a favorable impression of the product. Higher perceived value of second-hand luxury bags leads to stronger purchase intention."

The scale is adapted from Lin et al.^[63] and consists of 4 items.

Table 5. Purchase Intention Measurement Scale

Variable	Item
Purchase Intention	1. I would consider purchasing a second-hand luxury bag in the future.
	2. If the quality of a second-hand luxury bag (material, accessories, stitching, lining, color retention) is well maintained, I would be willing to buy it.
	3. Because second-hand luxury bags offer brand value, quality, design, craftsmanship, and affordability, I would consider purchasing one.
	4. I am willing to purchase a second-hand luxury bag if the price is reasonable.

3.3 Research Subjects and Sampling Method

The study targets Generation Z university students studying in the western region of Taiwan. Based on Comrey's^[66] recommendation, a sample size of over 300 is optimal. The survey was conducted from November 4 to November 29, 2024. A total of 352 valid responses were collected, with a valid response rate of approximately 95.6%.

The sampling method used was purposive sampling. To reduce cost, two strategies were employed:

Snowball sampling, by asking professors known to the researchers to distribute the online questionnaire to students after class;

Posting the questionnaire link in online student forums and communities on social platforms like Dcard (particularly in second-hand fashion and luxury brand boards). Participants were also encouraged to share the survey with friends and family to continue snowball sampling and increase participation.

4. Research Results and Analysis

4.1 Analysis of Personal Background Information

In the analysis of personal background information, the variable "gender" showed a majority of female respondents at 79.5%, with males accounting for 20.5%. For "registered residence," the northern region accounted for the largest proportion at 40.6%, followed by the central region at 30.1%, and the southern region at 28.7%. Regarding "age," the 24–27 age group made up the largest portion at 42%, followed by the 18–20 age group at 38.6%. For "year of study," seniors (4th year) comprised the largest group at 27%.

As for "part-time employment," 61.1% reported having a part-time job. The "location of current university" was predominantly in the northern region (38.6%), followed by the southern region (31.5%). For "academic field of study," the humanities, arts, and design fields made up 26.4%, followed by business, management, and law at 23.9%. Other fields included journalism, communication, and library science; science and engineering; education and humanities; agriculture, forestry, fisheries, and veterinary medicine; medical and social sciences; and leisure and sports.

Finally, for "monthly disposable allowance (income)," the NT\$6,001–20,000 range was the most common, accounting for 67.6%.

In terms of brand awareness, 41.8% fell into the "average" group based on their familiarity with luxury brands, followed by the "low" group at 29.3%, and the "high" group at 29%. Regarding self-assessed understanding of luxury brands, 50.9% placed themselves in the "average" group, followed by the "low" group at 29.5%, and the "high" group at 19.6%. These findings indicate that most Gen Z student consumers believe they have only a moderate understanding of luxury brands. This is consistent with the distribution of brand awareness scores based on brand selection, which also showed a majority in the average group.

Consumer behavior was analyzed in two categories: luxury fashion products and second-hand fashion products. The survey showed that a majority of participants had never purchased luxury fashion products (51.1%). Among those who had, bags were the most purchased item (34.2%), followed by clothing (shirts, pants, skirts, jackets) at 23%. Similarly, a majority (65.3%) had never purchased second-hand fashion products. For those who had, clothing (shirts, pants, skirts, jackets) was the most commonly purchased category (22.3%), followed by bags at 16.6%.

4.2 Reliability and Validity Analysis

This study used SmartPLS statistical software to conduct Confirmatory Factor Analysis (CFA) to determine whether the model demonstrated adequate reliability and validity. The analysis revealed that *Item 1* under Perceived Risk and *Items 6 and 7* under Perceived Value had factor loadings below 0.6 and were therefore removed from further analysis. The remaining items were retained for the reliability and validity analysis.

After removing the low-loading items, the Cronbach's α values for all research variables were greater than 0.7, and the t-values for all estimated parameters exceeded 1.96, reaching the level of statistical significance. The Composite Reliability (CR) values were all above 0.8, indicating high internal consistency and sample reliability^{[67][68]}. The Average Variance Extracted (AVE) values all exceeded 0.5, and the square roots of the AVE values for each variable dimension were greater than the correlations between that dimension and other dimensions in the model, demonstrating good convergent and discriminant validity^[69].

These results suggest that the measurement model used in this study meets academic standards in terms of internal consistency, indicator reliability, convergent validity, and discriminant validity. Tables 6 and 7 show the detailed analysis results.

Table 6. Measurement Model Parameter Estimates

Variable	Dimension	Item	Factor Loading	t-value	Cronbach's α	Composite Reliability (CR)	Average Variance Extracted (AVE)
Fashion Consciousness					0.895	0.916	0.578
	Fashion	1	0.851	41.027	0.881	0.913	0.678
		2	0.839	51.883			
		3	0.771	28.560			
		4	0.857	55.257			
		5	0.798	33.724			
	Brand	6	0.878	58.959	0.845	0.906	0.763
		7	0.860	49.153			
		8	0.882	78.592			
Perceived Residual Value		1	0.827	29.387	0.916	0.933	0.666
		2	0.847	41.904			
		3	0.802	35.513			
		4	0.869	57.864			
		5	0.858	49.624			
		6	0.770	25.264			
		7	0.730	19.186			
Perceived Risk		2	0.577	4.558	0.789	0.837	0.571
		3	0.905	10.178			
		4	0.625	5.305			
		5	0.863	10.068			
Perceived Value		1	0.863	50.858	0.857	0.898	0.640
		2	0.836	35.217			
		3	0.863	46.915			
		4	0.730	22.129			
		5	0.694	18.618			
Purchase Intention		1	0.882	61.976	0.929	0.950	0.825
		2	0.930	73.687			
		3	0.905	70.205			

Table 7. Discriminant Validity Test Table

Variable / Dimension	Fashion	Brand	Perceived Residual Value	Perceived Risk	Perceived Value	Purchase Intention
Fashion	0.824					
Brand	0.612	0.873				
Perceived Residual Value	0.416	0.408	0.816			
Perceived Risk	0.209	0.157	0.262	0.756		
Perceived Value	0.252	0.217	0.662	0.047	0.800	
Purchase Intention	0.448	0.412	0.707	0.223	0.616	0.909

Note: Bolded diagonal values represent the square root of the AVE. The off-diagonal values are the correlation coefficients between constructs.

4.3 Path Relationship Testing

4.3.1 Direct Effects

Based on the test results in Table 8, a path diagram of the conceptual model can be drawn, as shown in Figure 2. According to Table 8 and Figure 2, the following results were found in the research model:

H1: Fashion consciousness has a significant positive effect on the purchase intention of second-hand luxury bags ($t = 4.684, p < 0.001$).

H2: Fashion consciousness has a significant positive effect on perceived residual value ($t = 7.811, p < 0.001$).

H3: Perceived residual value has a significant positive effect on the purchase intention of second-hand luxury bags ($t = 5.732, p < 0.001$).

H5: Fashion consciousness has a significant positive effect on perceived value ($t = 4.159, p < 0.001$).

H6: Perceived value has a significant positive effect on the purchase intention of second-hand luxury bags ($t = 5.165, p < 0.001$).

The path coefficients for these five hypotheses are 0.207, 0.461, 0.398, 0.267, and 0.295, respectively. In other words, all five hypotheses are supported.

On the other hand:

H8: Perceived risk has a non-significant negative effect on the purchase intention of second-hand luxury bags ($t = 1.523$, $p > 0.05$).

H9: Perceived risk has a non-significant negative effect on perceived value ($t = 0.153$, $p > 0.05$).

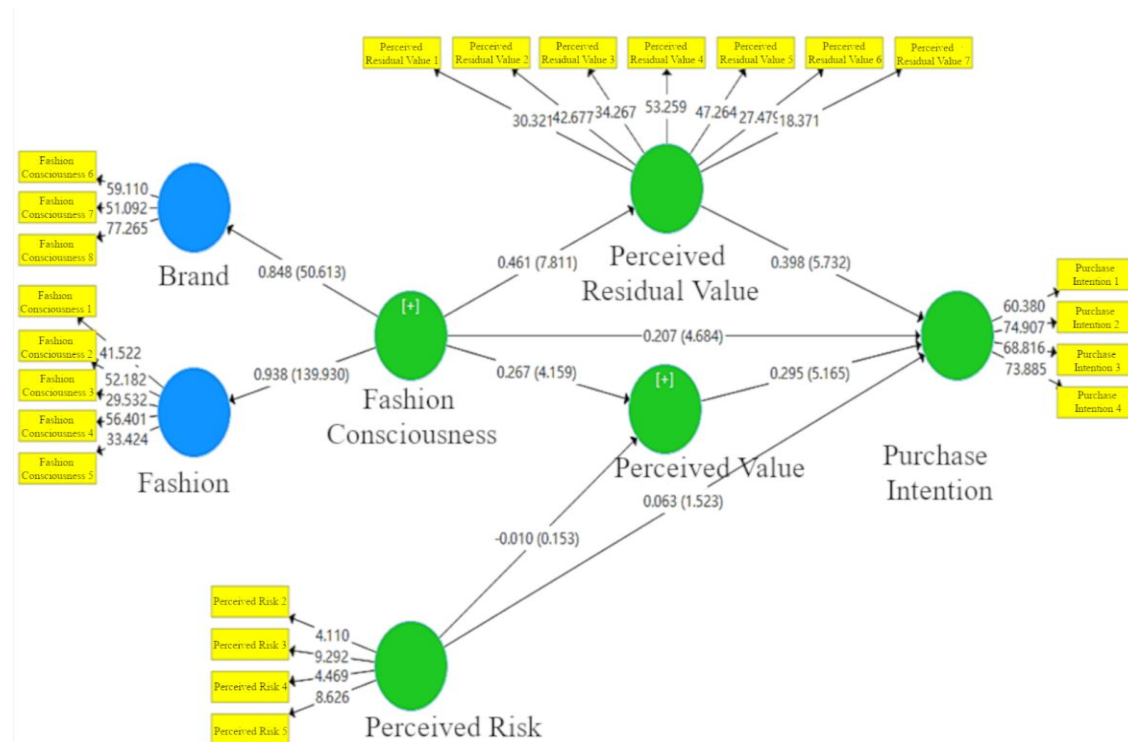
The path coefficients for these two hypotheses are 0.063 and -0.010, respectively. Therefore, both hypotheses are not supported.

Table 8. Path Analysis of the Structural Model

Hypotheses	Path	Path Coefficient	t-value	Decision
H1	Fashion Consciousness → Purchase Intention	0.207***	4.684	Supported
H2	Fashion Consciousness → Perceived Residual Value	0.461***	7.811	Supported
H3	Perceived Residual Value → Purchase Intention	0.398***	5.732	Supported
H5	Fashion Consciousness → Perceived Value	0.267***	4.159	Supported
H6	Perceived Value → Purchase Intention	0.295***	5.165	Supported
H8	Perceived Risk → Purchase Intention	0.063	1.523	Not supported
H9	Perceived Risk → Perceived Value	-0.010	0.153	Not supported

Note: *** indicates $p < 0.001$.

Figure 2: Path results of the structural model.



Note: The values in parentheses are *t*-values.

4.3.2 Mediation Effect Analysis

By using the bootstrapping method in SmartPLS to calculate *t*-values and confidence intervals, mediation effects were tested. When the *t*-value is greater than 1.96 and the 95% confidence interval for the indirect effect does not include 0, the mediation effect is considered significant. According to Table 9, which summarizes the direct, indirect, and total effects among the variables for multiple mediation effects, Perceived Residual Value and Perceived Value act as mediators in the relationship between Fashion Consciousness and Purchase Intention:

Fashion Consciousness → Perceived Residual Value → Secondhand Luxury Purchase Intention

"Fashion Consciousness" can significantly influence "Purchase Intention" indirectly through "Perceived Residual Value" ($t = 4.938, p < 0.001$). Therefore, Hypothesis H4 of this study is supported, indicating that "Perceived Residual Value" indeed plays a mediating role in the relationship between "Fashion Consciousness" and "Purchase Intention."

Fashion Consciousness → Perceived Value → Secondhand Luxury Purchase Intention
 "Fashion Consciousness" can significantly influence "Purchase Intention" indirectly through "Perceived Value" ($t = 3.329, p < 0.001$). Thus, Hypothesis H7 is supported, indicating that "Perceived Value" plays a mediating role in the relationship between "Fashion Consciousness" and "Purchase Intention."

Perceived Risk → Perceived Value → Secondhand Luxury Purchase Intention
 "Perceived Risk" does not significantly influence "Purchase Intention" indirectly through "Perceived Value" ($t = 0.147, p > 0.05$). Therefore, Hypothesis H10 is not supported, indicating that "Perceived Value" does not play a mediating role between "Perceived Risk" and "Purchase Intention."

The analysis results show that "Fashion Consciousness" indirectly affects "Purchase Intention" through two mediating variables: "Perceived Residual Value" and "Perceived Value." The VAF (Variance Accounted For) value was then used to assess the strength of the mediation effect. The VAF indicates the proportion of the indirect effect relative to the total effect. When the VAF is less than 20%, there is no mediation effect; a VAF between 20% and 80% indicates partial mediation; and a VAF greater than 80% indicates full mediation^[70].

Based on Table 9, it can be determined that both "Perceived Residual Value" and "Perceived Value" exhibit partial mediation effects, with the mediation effect of "Perceived Residual Value" being the stronger of the two (VAF = 62.37% > 26.78%).

Table 9. Multiple Mediation Effect Analysis Table

Effect	Regression Coefficient	t-value	95% Confidence Interval		VAF
			Lower Bound	Upper Bound	
Indirect Effects					
Fashion Consciousness → Perceived Residual Value → Purchase Intention	0.184***	4.938	0.116	0.265	62.37%
Fashion Consciousness → Perceived Value → Purchase Intention	0.079***	3.329	0.041	0.135	26.78%
Perceived Risk → Perceived Value → Purchase Intention	-0.003	0.147	-0.058	0.027	-5.17%
Direct Effects					
Fashion Consciousness → Perceived Residual Value	0.461***	7.811	0.328	0.571	
Fashion Consciousness → Perceived Value	0.267***	4.159	0.134	0.387	
Perceived Risk → Perceived Value	-0.010	0.153	-0.158	0.094	
Perceived Residual Value → Purchase Intention	0.398***	5.732	0.24	0.523	
Fashion Consciousness → Purchase Intention	0.207***	4.684	0.126	0.293	
Perceived Risk → Purchase Intention	0.063	1.523	-0.03	0.136	
Perceived Value → Purchase Intention	0.295***	5.165	0.185	0.415	
Total Effects					
Fashion Consciousness → Purchase Intention	0.295***	5.028	0.352	0.562	
Perceived Risk → Purchase Intention	0.058	1.312	-0.045	0.129	

Note: *p < .001.

5. Conclusion and Recommendations

5.1 Research Conclusions

Based on the results of structural equation modeling analysis, this study draws three main conclusions:

First, “Perceived Residual Value” plays a partial mediating role between fashion consciousness and purchase intention. This aligns with Keller's^[71] perspective that the more consumers understand brand information, the stronger their connection with the brand, leading them to value the product's design, craftsmanship, and brand value rather than signs of depreciation^[45]. This indicates that perceived residual value not only reduces the negative impact of depreciation on purchase intention, but can also transform the depreciation characteristics into positive buying motivation, bringing a sense of value recognition to consumers. Stolz^[14] and Sun et al.^[43] also pointed out that luxury brand products, even with signs of depreciation, still attract consumers due to their high quality, classic design, and durability.

Second, “Perceived Value” also plays a partial mediating role between fashion consciousness and purchase intention. The result is consistent with the findings of Salem and Alanadoly^[54], showing that when consumers highly value fashion trends or frequently follow new designs, they are more likely to develop positive evaluations of trendy products, which in turn stimulates their purchasing behavior. This further proves the importance of perceived value in consumers' purchase decision-making.

Third, “Perceived Risk” does not mediate the relationship between fashion consciousness and purchase intention. The analysis shows that perceived risk has no significant impact on purchase intention and does not influence purchase intention through perceived value either. Although this result differs from the original hypothesis, it aligns with the findings of Chang and Tseng^[72], which revealed that for Taiwanese consumers, perceived risk in online shopping does not influence purchase intention through perceived value. Similarly, Lou et al.^[57] found that American consumers are less concerned about the risks of second-hand luxury goods, and this risk does not affect their intention to purchase.

5.2 Practical Managerial Implications and Recommendations

The results of this study confirm that perceived residual value plays a critical role in consumers' purchasing behavior toward second-hand luxury goods. Therefore,

sellers of second-hand luxury products, particularly when targeting consumers who follow fashion trends, should package the unique depreciation characteristics of luxury brands as added value — such as superior quality, durability, or trendy design. This approach allows depreciation to be reframed as a positive driver of purchase intention.

Furthermore, the findings also reveal that fashion consciousness is a key factor in activating the two mediating pathways of perceived residual value and perceived value. Consumers lacking fashion consciousness may fail to develop a positive perception of second-hand luxury handbags, reducing their purchase intention. Hence, fashion consciousness is a foundational variable that connects all others. Based on this, the study suggests that businesses formulating strategies for the second-hand luxury market should focus on the dissemination of fashion-related information and product selection mechanisms, aiming to highlight the product's value rather than overly fixating on minimizing consumers' risk concerns.

Specific managerial recommendations are discussed from four perspectives:

Promote internalization of fashion trends: Businesses should proactively guide consumers to internalize current trends by organizing brand culture lectures, fashion salons, or styling workshops. These activities help consumers understand the design philosophy and fashion value of luxury products. Through such diverse initiatives, businesses can not only engage consumers but also reinforce their sense of identity with luxury brands, thereby increasing purchase intention.

Strengthen the connection between products and current fashion trends: By showcasing styling guides for second-hand luxury goods on social media or fashion platforms, businesses can demonstrate the fashion value of their products while providing consumers with inspiration for outfit coordination.

Communicate the advantages of the products: This includes emphasizing quality assurance, brand value, and the cost-performance ratio compared to new products. By doing so, businesses can help shape a positive perception among consumers regarding second-hand luxury items.

Establish a transparent product grading system: Clearly indicate the degree of depreciation and the corresponding value of each second-hand item. This enables consumers to rationally assess the condition and worth of the product.

These strategies not only effectively enhance purchase intention but also help establish a long-term competitive edge in the second-hand luxury market. Although this

study stresses that it is unnecessary to overly focus on reducing perceived risk, such risks should not be entirely ignored. Businesses should first ensure that risk-related concerns are well-controlled, and then implement the above-mentioned managerial policies.

5.3 Recommendations for Future Research

This study focused exclusively on students from Generation Z, which limits its ability to represent the broader market of consumers. Future research is recommended to expand the sample scope to include different age groups, occupations, and even consumers from other countries to gain a more comprehensive understanding of the factors influencing purchase intentions. It is worth emphasizing that the structural model proposed and empirically tested in this study has shown applicability and explanatory power across different samples, indicating a certain degree of generalizability. In other words, the model from this study can serve as a reference for future research targeting other generations or demographic groups, providing a universally applicable theoretical framework.

This study used a questionnaire survey method, with items adapted from existing academic scales based on a literature review. It is recommended that future studies explore qualitative interview methods to gain deeper insights into the core factors that truly influence consumers' behavior when purchasing second-hand luxury goods. Additionally, this study utilized online distribution for the questionnaire, which may carry the risk of inattentive or insincere responses. Thus, future studies could consider using paper-based surveys as an alternative.

This study represents a preliminary investigation into Generation Z consumers' purchase intentions toward second-hand luxury goods and did not further differentiate between types of luxury brands. However, recent years have seen a growing distinction between “premium” and “luxury” categories within the brand landscape. To explore these differences more thoroughly, it is recommended that future research conduct separate studies on premium versus luxury goods, to examine variations in consumer perception and behavior. Furthermore, comparisons between luxury brands and non-luxury brands could help clarify whether luxury products truly perform better in the second-hand market.

This study found that fashion consciousness influences purchase intention indirectly through two mediating variables: perceived residual value and perceived

value. These two variables were identified as the most and second-most influential factors in the research model. However, they were only used to verify mediation effects. Future studies may consider introducing additional influencing variables or treating these as moderating variables, to further explore the multiple causes of purchase intention.

As for the measurement of perceived residual value, this study relied on a modified version of existing academic scales. Currently, there are no standardized evaluation criteria for depreciation levels in the fashion industry. Future studies might consider employing experimental methods to present different levels of product depreciation visually or physically, to further explore consumer reactions and evaluations. This approach could help establish more concrete measurement standards.

Lastly, the study found that perceived risk, when treated as an independent variable, did not significantly influence purchase intention. This suggests that consumers may not prioritize perceived risk when purchasing second-hand luxury goods. Therefore, future studies could consider treating perceived risk as a moderating variable, to observe whether its influence varies depending on its position within different models.

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The Impact of ESG on Sales Changes

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Abstract

This study examines the impact of Environmental, Social, and Governance (ESG) practices on corporate sales stability among non-financial firms listed in Taiwan from 2008 to 2024. Using panel data regression, results show that strong ESG performance is significantly associated with reduced sales volatility, indicating that proactive ESG engagement helps firms maintain market share and customer confidence. Effective corporate governance, including independent boards and aligned managerial incentives, further strengthens this relationship.

Conversely, frequent ESG-related controversies increase sales fluctuations, highlighting the importance of risk management. The findings suggest that embedding ESG principles into corporate strategy enhances financial stability and competitive advantage, offering valuable insights for corporate leaders aiming for sustainable growth and resilience in dynamic markets.

Keywords: ESG, Corporate Governance, Panel Data, Corporate Sales Changes

1. Introduction

Within the corporate governance framework, corporate social responsibility (CSR) has received increasing attention in academic research in recent years. Bae and El Ghouli (2018) examined whether CSR can mitigate the risks that highly leveraged firms face. Their findings indicate that the significant losses in market share experienced by highly leveraged companies are often the result of adverse reactions from customers and competitors. Customers may avoid purchasing from highly leveraged firms due to concerns that such companies might reduce product quality or cease production, thereby imposing losses on the consumer. On the other hand, competitors may engage in predatory behaviors—such as capital-intensive promotional campaigns, aggressive discounting, or negative advertising—targeted at weakening the competitive position of these financially vulnerable firms.

When highly leveraged firms encounter difficulties in accessing capital or face high capital costs, they are generally unable to withstand such predatory competition, ultimately leading to substantial losses in market share. However, CSR has been shown to play a moderating role in this context. For highly leveraged firms, CSR initiatives can help mitigate the negative consequences of stakeholder behaviors by fostering customer loyalty and discouraging aggressive competitive tactics. The study concludes that CSR can effectively buffer the adverse effects of financial leverage on product market outcomes by reducing stakeholder-driven risks.

In response to domestic and international corporate governance failures, Taiwan's Financial Supervisory Commission (FSC) adopted the corporate governance framework established by the Organisation for Economic Co-operation and Development (OECD) and began promoting various governance-related regulations nationwide. In 2002, the FSC mandated that all companies applying for listing on the Taiwan Stock Exchange or over-the-counter markets appoint independent directors to their boards. In 2005 a Corporate Governance Evaluation System was introduced to assess governance practices among listed firms. By 2007, comprehensive corporate governance mechanisms had been formally implemented to enhance transparency, accountability, and investor protection within the capital markets.

In recent years, the discourse on corporate governance and corporate social responsibility (CSR) has increasingly evolved into the Environmental, Social, and Governance (ESG) framework, reflecting a more integrated and measurable approach

to sustainability and accountability. Traditionally, CSR focused on voluntary ethical initiatives and philanthropy, while corporate governance emphasized structures and processes ensuring transparency and stakeholder alignment. However, ESG synthesizes these elements by incorporating environmental impact, social relationships, and governance mechanisms into a standardized framework increasingly subject to regulatory and investor scrutiny (Kumar, King, & Ranta, 2023). Kumar et al. (2023) highlight that effective corporate governance, including independent boards and robust oversight, forms the foundation for credible ESG implementation and disclosure, enhancing transparency and legitimacy. Moreover, ESG is regarded as an evolution of CSR, providing quantifiable metrics that enable companies to operationalize sustainability goals and create long-term value (Ellili, 2022). This transition improves financial performance and risk management and introduces challenges such as greenwashing and the need for standardized methodologies. Embedding environmental and social considerations within governance structures through ESG represents a paradigm shift in corporate evaluation and value creation, aligning business conduct with broader societal expectations.

Due to the distinct characteristics, asset structures (e.g., real estate holdings), and financial products of firms in the financial industry, these companies are subject to more stringent government regulations than their non-financial counterparts. As a result, the outcomes of ESG practices often differ substantially between financial and non-financial firms. Given these structural disparities, this study focuses exclusively on non-financial companies listed on the Taiwan Stock Exchange and over-the-counter markets, explicitly excluding firms in the banking, insurance, and securities sectors. The research investigates whether ESG initiatives among non-financial firms in Taiwan can enhance investor confidence and contribute to stabilizing corporate earnings.

This study investigates the impact of ESG practices on changes in corporate sales, using corporate governance evaluation scores and the level of information transparency as proxy variables for ESG performance. The research explores how ESG initiatives affect stakeholders and whether their implementation induces fluctuations in a firm's sales performance. Additionally, the study examines whether adverse ESG-related news events within an industry have spillover effects on peer firms' sales outcomes.

To conduct this analysis, the study compiles the total number of adverse corporate events involving listed companies in Taiwan from 2008 onward. It further calculates

the annual proportion of these events relative to the total number of ESG-related incidents within each industry. This ratio is then analyzed to determine whether it correlates significantly with corporate sales volatility. Through this framework, the study seeks to understand how ESG engagement influences stakeholders and whether reputational damage from ESG controversies adversely affects investor confidence.

The empirical results of this study indicate a statistically significant relationship between a firm's ESG engagement and its market competitiveness. The findings suggest that, despite the potentially high costs associated with ESG implementation, such efforts contribute to stable profitability and are positively reflected in a company's ability to maintain a competitive advantage. Specifically, firms with stronger ESG performance will more likely preserve their market share and sustain consumer confidence within their industry and target markets.

Additionally, the study reveals that when companies take steps to protect the interests of their agents—such as by purchasing directors' and officers' liability insurance—management teams are more capable of concentrating on operational effectiveness. This increased managerial focus is associated with enhanced profitability, underscoring the broader financial benefits of sound governance practices.

The rest of the paper is organized as follows. In Section 2, we present the literature. Section 3 presents the sample, the variables, and the methodology to investigate the relationship between ESG and Sales Changes. Section 4 presents our results. Section 5 is the conclusion.

2. Hypothesis Development

ESG has a substantive and critical impact on corporate performance. Notably, the halo effect associated with ESG practices serves as a form of quasi-insurance for firms, helping to mitigate customer distrust and negative perceptions. It also reduces the likelihood of competitors exploiting a firm's weakened financial condition. Studies by Hong and Liskovich (2015) and Lins, Servaes, and Tamayo (2017) have demonstrated that the ESG halo effect enhances trust between firms and their stakeholder groups.

In corporate governance, Chen et al. (2015) found that higher-quality governance reduces firm-specific risk, decreasing the likelihood of negatively skewed stock returns. This governance stability contributes to stronger corporate development and greater investor confidence.

Regarding corporate social responsibility (CSR), Bae and El Ghouli (2018) investigated whether CSR can reduce risk for highly leveraged firms. Their findings suggest that companies with strong CSR engagement are perceived as having lower risk and tend to attract a broader base of investors (Waddock & Graves, 1997; Hong & Kacperczyk, 2009; El Ghouli et al., 2011). These companies benefit from better access to capital and reduced cost of financing (Merton, 1987; Heinkel, Kraus, & Zechner, 2001; Gao, Li, & Ma, 2018), which weakens the impact of predatory competitive behaviors.

The primary objective of business operations is profitability. Throughout the operational process, companies aim to maintain gross margins by securing market share or product uniqueness, and may also pursue additional earnings through reinvestment. Establishing efficient marketing strategies and diverse distribution channels allows firms to meet market demands better. A well-structured organization with specialized departments, capable management teams, and robust administrative systems enables companies to grow steadily and respond effectively to unexpected challenges. Sustained product development and innovation are also critical to prevent competitors from surpassing a firm's offerings in terms of quality, or from capturing market share by undercutting price or perceived value. Effective financial control, including capital-raising and financial leverage, also plays a key role in managing costs and capital expenditures across these operational areas.

Given firm characteristics and product category variations, each company naturally develops its unique sales model and cost structures. However, market demand remains relatively stable without external shocks, such as financial crises, natural disasters, or pandemics. This environmental stability provides a sound foundation for investigating whether ESG performance has a measurable impact on changes in sales.

While many complex factors drive corporate revenue fluctuations, minimal year-over-year sales changes may indicate stable market share and profitability. In this context, it is worth exploring whether implementing corporate governance structures and pursuing CSR initiatives affect core product sales performance. Previous studies suggest that sound governance mechanisms can enhance firm performance, increase shareholder value, and reduce operational costs (Agrawal & Knoeber, 1996; Black et al., 2002). Chen (2010) further found that stronger governance reduces firm-specific risk. Based on this literature, the current study adopts corporate revenue variation as

the dependent variable and examines the influence of ESG-related factors on such variation.

Ownership Structure and Corporate Control

Ownership structure forms the foundation of corporate property rights and plays a critical role in shaping a firm's operations, investment decisions, and exercising control rights. Within this structure, large shareholders occupy a pivotal position. Numerous studies have recognized that large shareholders possess substantial power to monitor and influence corporate governance. According to Shleifer and Vishny (1986), the more concentrated the ownership held by major shareholders, the greater their ability to oversee corporate operations and constrain managerial discretion.

However, excessive concentration of ownership—particularly when held by a small number of controlling or insider shareholders—can lead to the expropriation of minority shareholders' interests (Claessens et al., 2000). In such contexts, independent outside directors, who do not participate in day-to-day management and whose interests align more closely with those of general shareholders, may enhance the effectiveness of corporate oversight (Cadbury, 1992). Chen (2015) further found that when ownership is more concentrated in institutional investors and external block-holders, firms tend to exhibit higher skewness in firm condition indicators, which is associated with more favorable stock return distributions.

The board of directors is a critical component of corporate governance, serving as the highest authority in determining the firm's strategic direction and profit-oriented policies. It also plays a pivotal role in safeguarding the fair treatment of investors. Generally, board members can be categorized into two groups: internal directors and external directors. Internal directors hold executive positions within the company, and thus may be influenced by personal interests that could potentially conflict with those of other stakeholders. In contrast, external directors do not participate in daily operations and are therefore considered more likely to align with the interests of investors, fulfilling an essential monitoring role.

Institutional investors can also provide management with more comprehensive insights and strategic recommendations due to their informational advantages and broader investment perspective management with more comprehensive insights and strategic recommendations due to their informational advantages and broader

investment perspectives. This can help reduce the likelihood of managerial errors in policy implementation.

Based on this governance structure, the study proposes the following hypotheses:

Hypothesis 1a: The higher the shareholding ratio of external block-holders, the smaller the variation in corporate sales.

Hypothesis 1b: The higher the shareholding ratio of institutional investors, the smaller the variation in corporate sales.

Board Independence and Corporate Governance Reform

The board of directors is the highest governing body within a corporation, composed of multiple board members collectively responsible for major strategic decisions and oversight. In smaller firms, however, there is often a high degree of overlap between board members and shareholders, which can hinder the separation of powers and compromise the board's ability to check managerial behavior effectively. When board members concurrently hold executive positions, their monitoring role becomes further weakened, undermining stakeholder confidence in corporate operations.

Bai et al. (2004) found that when boards are dominated by management, their oversight effectiveness is significantly limited. To strengthen corporate governance, Taiwan introduced the independent director mechanism in 2002. In 2006, the independent director mechanism was formalized into law, and by 2017, all publicly listed companies were required to appoint independent directors.

Independent directors serve on the board without holding any managerial or operational role. These individuals must possess both professional competence and independence. Moreover, they are mandated to serve as members of the audit committee, where they are expected to oversee corporate performance and financial integrity. The aim is to prevent fraudulent financial reporting, misappropriation of assets, and the dissemination of misleading profit information that may compromise shareholder understanding and market transparency.

Since 2002, Taiwan's Financial Supervisory Commission (FSC) has actively mandated the appointment of independent directors for all listed companies. In 2006, this requirement was formally codified in the Securities and Exchange Act, which stipulated that the number of independent directors must not be fewer than two per company. The primary value of independent directors lies in their independence and

expertise. As they do not maintain business relationships with the firm, they are better positioned to monitor and balance governance structures, particularly within family-controlled firms, a standard ownership model in Taiwan. In addition to their supervisory role, highly professional independent directors can contribute valuable strategic insights based on their expertise, which may enhance the firm's overall profitability.

Based on this institutional context, the following hypothesis is proposed:

Hypothesis 3: The higher the proportion of independent directors and supervisors on the board, the smaller the variation in corporate sales.

Executive Incentive Mechanisms

According to agency theory (Jensen & Meckling, 1976), when managers are also owners of the firm, they are naturally motivated to act in the company's best interest. However, when firms raise external capital, managers—who often possess information advantages—may act in their self-interest, potentially at the expense of various stakeholders. This misalignment of incentives underscores the importance of external monitoring mechanisms, such as oversight by outside shareholders and independent directors.

In addition to governance-based monitoring, numerous studies have emphasized the role of well-structured executive compensation systems in aligning managerial and shareholder interests. A well-designed and competitive pay structure can motivate senior executives to contribute more effectively to the firm. Patton (1951) found a positive correlation between executive incentive schemes and firm profitability and growth.

Furthermore, greater transparency in executive compensation strengthens the relationship between managerial pay and firm performance (Vafeas & Afxentiou, 1998; Perry & Zenner, 2001; Park, Nelson, & Huson, 2001). Equity-based compensation, wherein managers hold ownership stakes in the firm, reinforces this alignment. Under the convergence of interest hypothesis (Jensen & Meckling, 1976), higher managerial shareholding creates more substantial incentives to improve firm performance, as declines in share price would directly reduce the manager's wealth.

Agency relationships in corporate operations are often accompanied by moral hazard, cost allocation, and profit distribution issues. The perceived contribution of managers to corporate performance and differing views on profit-sharing mechanisms frequently result in discrepancies between managerial and shareholder expectations

regarding compensation. Under such circumstances, managers may respond with passive behavior or, in more severe cases, exploit their positions to extract private benefits not contractually agreed upon with the firm.

To reconcile these conflicting interests and to establish a common profit-maximization objective, managerial shareholding has been widely recognized as a simple yet effective mechanism. In addition to fixed salaries and performance-based bonuses, granting equity stakes to managers aligns their interests with those of shareholders. Under the premise of maximizing personal wealth, managerial ownership encourages executives to enhance firm value and act in line with shareholder objectives.

Based on this rationale, the study proposes the following hypothesis:

Hypothesis 4: The higher the managerial ownership ratio, the smaller the variation in corporate sales.

ESG-Related Negative Events and Their Impact on Sales Changes

A study by Kee-Hong Bae (2018) showed that corporate social responsibility (CSR) can mitigate the loss of market share. As more firms begin to recognize the strategic value of ESG and allocate resources toward related initiatives, it becomes increasingly complex to isolate the causal effects of ESG performance on competitive outcomes. For instance, large firms may be able to invest more heavily in ESG to gain a competitive edge or defend market share against rivals. However, this advantage does not necessarily imply that ESG is the cause of enhanced competitiveness.

To investigate the relationship between CSR failures and firm performance, this study examines data from 2008 to 2020, focusing on non-financial firms in Taiwan. Specifically, it records the number of CSR-related adverse news events for each firm annually and aggregates the total number of such events by industry. The firm-level event count is then divided by the industry-level total to calculate a relative ratio. This ratio is used to assess whether firms experiencing more CSR-related controversies within the same industry exhibit greater variations in sales.

Based on this framework, the following hypothesis is proposed:

Hypothesis 5: The greater the number of CSR-related adverse events a firm experiences, the larger the variation in its corporate sales.

3. Methodology

This study investigates publicly listed companies on the Taiwan Stock Exchange (TWSE) and the Taipei Exchange (TPEX), excluding firms in the financial, insurance, and securities sectors due to the unique nature of their business models and regulatory frameworks. Industry classification follows the categorization provided by the Taiwan Economic Journal (TEJ) database. Firms with missing or incomplete data were also excluded from the sample.

After screening, the final dataset includes 1,655 firms across 27 industries, yielding 28,951 firm-year observations. The data utilized in this study are primarily obtained from the TEJ database, which encompasses various dimensions such as firm financials, corporate governance, and board structures. Specific data points include changes in board and supervisor composition, financial statements by the International Financial Reporting Standards (IFRS)—including balance sheets, income statements, and cash flow statements—and details on shareholding structures and governance variables related to board and supervisor composition.

Variable Definitions and Measurement

This section outlines the proxy variables and measurement methods used to capture four key constructs in the study: ownership structure, board composition, executive incentive mechanisms, and adverse ESG-related events. Each construct is operationalized using measurable indicators based on prior literature and available data. In addition, this section introduces the control variables included in the empirical model to account for firm-specific characteristics and potential confounding effects.

Corporate Sales Variation

Corporate sales variation (SALESRATE) is calculated to observe firm-level sales performance relative to industry peers within the non-financial sector. A firm's net operating revenue for the fiscal year represents the annual sales data. The rate of sales variation is computed as the difference between the current year's operating revenue and that of the previous year, divided by the current year's operating revenue.

External Block-Holder Ownership Ratio

External block-holder ownership ratio (BOR) represents the proportion of company shares held by external shareholders among the top ten. It excludes those who concurrently serve as directors, supervisors, or managers. The calculation aggregates

the total shareholding of non-managerial top ten shareholders and shareholders owning more than 5% of total shares, divided by the firm's total outstanding shares.

Institutional Ownership Ratio

Institutional ownership ratio (IOR) reflects the shareholding of institutional investors and is used to assess the monitoring function of the board. This includes the shareholdings of foreign financial institutions, legal entities, trusts, and investment firms. The ratio is computed by dividing the total shares held by these institutions by the total shares outstanding of the sample firm.

Ratio of Independent Directors and Supervisors

The ratio of independent directors and supervisors (INDR) measures board independence. It is calculated as the number of independent directors and supervisors divided by the total number of board members for a given year.

Managerial Ownership Ratio

Managerial ownership ratio (MOR) is used as a proxy for executive incentive mechanisms. It includes shareholdings held by managers, directors, and supervisors who have business relationships with the firm. The total is divided by the firm's total outstanding shares.

ESG-Related Negative Event Ratio

ESG-related negative event ratio (ESGRATIO) examines whether a firm's involvement in ESG-related controversies affects its relative standing within the same industry. The variable is calculated as the total number of ESG-related adverse news events associated with a sample firm in a given year (regardless of severity), divided by the total number of events occurring within the same industry. Industry classifications follow the categorization provided by the Taiwan Economic Journal (TEJ).

Control Variables

To examine whether ESG-related factors contribute to fluctuations in corporate profitability among Taiwanese firms, this study incorporates several control variables, drawing from Chen (2010), which investigated the impact of corporate governance mechanisms on firm-specific risk. The following variables are included to account for firm-level characteristics and potential confounders: **firm size** ($LNSIZE_{i,t}$), **market-**

to-book ratio ($MTBi, \tau$), **firm age** ($AGEi, \tau$), **auditor turnover in the past three years** ($CPAi, \tau$), **leverage ratio** ($LEVi, \tau$), **stock turnover ratio** (TVi, τ), **capital expenditure ratio** (CEi, τ), and **return on assets** ($ROAi, \tau$). Descriptions for each are as follows:

Firm size ($LNSIZEi, \tau$): The natural logarithm of the market value of firm i in year τ .

Market-to-book ratio ($MTBi, \tau$): The ratio of market capitalization to book value of equity for firm i in year τ .

Firm age ($AGEi, \tau$): The years since firm i was established, calculated as year τ , starting from 2008.

Auditor turnover ($CPAi, \tau$): The number of times firm i changed its certified public accountant within the three years prior to year τ .

Leverage ratio ($LEVi, \tau$): The total liabilities divided by the total assets of firm i in year τ .

Stock turnover ratio (TVi, τ): The trading volume of firm i 's stock divided by its total number of outstanding shares in year τ .

Capital expenditure ratio (CEi, τ): The value of firm i 's fixed assets divided by total assets in year τ .

Return on assets ($ROAi, \tau$): Net operating income divided by total assets for firm i in year τ .

Empirical Model and Statistical Methodology

This study adopts the Hausman test to examine whether the explanatory variables exhibit endogeneity, thereby guiding the appropriate model specification for panel data analysis. The empirical model is based on panel data constructed from firm-level financial information disclosed in the annual reports of all listed and OTC companies in Taiwan, as categorized by the Taiwan Economic Journal (TEJ). The data cover the period from 2008 to 2020 and include variables such as total assets, board structure, and ownership composition.

A panel data model enhances estimation accuracy and minimizes multicollinearity among explanatory variables. Panel data increases freedom and estimation efficiency and allows for analyzing dynamic behavior across time and individual firms.

The panel data regression model used in this study is specified as follows:

$$SALESRAT_{i,\tau} = \beta_0 + \beta_1 BOR_{i,\tau} + \beta_2 IOR_{i,\tau} + \beta_3 INDR_{i,\tau} + \beta_4 MOR_{i,\tau} + \beta_5 ESGRATIO_{i,\tau} + \sum_1^k \gamma_k Control_{k,(i,\tau)} + \varepsilon_{i,\tau}$$

Where:

$SALESRAT_{i,\tau}$ is the variation in corporate sales for firm i in year τ ;

BOR, IOR, INDR, MOR, and ESGRATIO are the key independent variables defined earlier.

$Control_{k,(i,\tau)}$ denotes the set of K control variables;

$\varepsilon_{i,\tau}$ is the idiosyncratic error term.

4. Empirical Results

Preliminary Analysis

This study investigates whether ESG performance influences the variation in corporate sales among listed and OTC companies in Taiwan from 2008 to 2024, excluding firms in the financial, insurance, and securities sectors. Industry classification follows the categorization provided by the Taiwan Economic Journal (TEJ). Firms with missing or incomplete data were also excluded, resulting in a final sample of 1,655 firms across 27 industries, yielding 28,951 firm-year observations. Table 1 presents the descriptive statistics for the key variables used in this study.

The analysis, conducted at the industry level for robustness, reveals that the average annual sales variation (SALESRATE) across sample firms is 1.412, with a standard deviation of 82.508, indicating substantial variability in firm performance. The mean value of ESG-related adverse news events (ESGRATIO) is 0.019, with a standard deviation of 0.088, suggesting that most firms have taken preventive ESG measures to avoid reputational risks.

The average external block-holder ownership ratio (BOR) is 0.223, and the institutional ownership ratio (IOR) is 0.107. Compared to prior research by Chen (2010), which found an average BOR of 0.172 for the 2002–2006 period, the current figures reflect a significant increase in external oversight, while institutional ownership remains stable at around 10%.

The proportion of independent directors and supervisors (INDR) averages 0.265, doubling the 0.12 reported from 2002–2006. This reflects the successful implementation of regulatory mandates on board independence. Conversely, the managerial ownership ratio (MOR) has decreased markedly to 0.043, down from 0.245

in earlier years. This decline may reflect a governance shift away from manager-dominated ownership structures toward more professionally managed firms.

	Mean	Std. Dev.	Q1	Median	Q3	N
$SALESRAT_{i,\tau}$	1.412	82.508	-0.110	0.008	0.128	28,951
$ESGRATIO_{i,\tau}$	0.019	0.088	0.000	0.000	0.000	28,951
$BOR_{i,\tau}$	0.223	0.125	0.133	0.199	0.286	28,951
$IOR_{i,\tau}$	0.107	0.161	0.006	0.039	0.130	28,951
$INDR_{i,\tau}$	0.265	0.171	0.167	0.286	0.400	28,951
$MOR_{i,\tau}$	0.043	0.060	0.003	0.020	0.060	28,951

Note: Q1 denotes the first quartile; Q3 denotes the third quartile. $SALESRAT_{i,\tau}$: The sales variation for firm i between year τ . $ESGRATIO_{i,\tau}$: The ESG-related negative event ratio for firm i between year τ . $BOR_{i,\tau}$: The external block-holder ownership ratio of firm i in year τ . $IOR_{i,\tau}$: The institutional ownership ratio of firm i in year τ . $INDR_{i,\tau}$: The proportion of independent directors and supervisors to total board members in firm i in year τ . $MOR_{i,\tau}$: The managerial ownership ratio of firm i in year τ .

Table 1. Descriptive Statistics of Key Variables for All Sample Firms (2008–2024)

Correlation Analysis of Research Variables

This study applies Pearson’s correlation coefficient to examine the relationships among key variables (see Table 2). The correlation matrix focuses on the association between sales variation and various independent and control variables. Statistical significance is assessed at the 5% ($p < 0.05$).

Unexpectedly, a positive and significant correlation is observed between external block-holder ownership and sales variation, indicating that greater external ownership is associated with larger fluctuations in firm revenue, contrary to the expectations in this study's hypotheses.

In addition, the number of auditor changes within the past three years is positively and significantly correlated with sales variation. This implies that frequent auditor turnover may reflect instability or reduced financial credibility, leading to greater sales fluctuations.

Lastly, the capital expenditure ratio exhibits a negative and significant correlation with sales variation, suggesting that firms with lower capital investment experience more volatile sales, potentially due to limited innovation or production capacity.

Table 2. Pearson Correlation Matrix of Key Research Variables

	SALESRA TE	ESGRA TIO	BOR	MOR	IOR	INDR	CPA	LNSIZ E	MTB	AGE	LEV	TV	CE	ROA
SALESRA TE	1	-0.004	0.029	0.005	-0.008	-0.001	0.022	-0.008	0.001	0.012	0.010	-0.009	-0.027	0.001
ESGRATI O		1	-0.001	-0.053	0.046	-0.045	0.015	0.169	-0.005	0.102	0.077	-0.045	0.104	-0.017
BOR			1	-0.035	0.146	0.073	0.017	-0.033	0.063	0.014	0.083	-0.227	0.03	-0.028
MOR				1	-0.101	0.066	-0.043	-0.164	-0.004	-0.115	-0.062	-0.023	-0.11	0.034
IOR					1	0.13	-0.07	0.44	0.083	-0.089	0.041	-0.016	-0.008	0.218
INDR						1	-0.034	-0.025	0.059	-0.308	-0.051	0.06	-0.15	0.048
CPA							1	-0.101	0.05	0.026	0.02	-0.011	0.018	-0.111
LNSIZE								1	0.088	0.143	0.051	0.147	0.112	0.417
MTB									1	-0.076	0.057	0.068	-0.049	0.015
AGE										1	0.115	-0.088	0.198	-0.14
LEV											1	-0.05	0.033	-0.151
TV												1	-0.099	0.195
CE													1	-0.048

Regression Results

This study utilizes panel data from all listed and OTC (Over-the-Counter) companies in Taiwan from 2008 to 2024. The final dataset excludes financial, insurance, and securities firms due to their distinct regulatory and operational frameworks. This results in a non-financial dataset unsuitable for examining the effects of ESG-related factors on sales variation. Based on firm-year observations across 27 industries, the dataset includes 1,655 unique firms and 28,951 practical observations.

The following section presents the descriptive statistics, correlation matrix, and results from panel regression models, focusing on the influence of ownership structure, board composition, executive incentives, and ESG-related controversies on the variation in corporate sales. The analysis uses fixed and random-effects models, with the Hausman test employed to determine the most appropriate specification.

Table 1. Regression Results on the Impact of ESG on Sales Variation

Explanatory Variable (expected sign)	Dependent Variable: $SALESRAT_{i,j}$ (p value)
<i>Intercept</i>	-1.2285 (0.9248)
$BOR_{i,\tau}(-)$	17.2155 (0.0011)***
$IOR_{i,\tau}(-)$	-3.2463 (0.4704)
$INDR_{i,\tau}(-)$	1.7894 (0.6864)
$MOR_{i,\tau}(-)$	7.9336 (0.4601)
$ESGRATIO_{i,\tau}(+)$	0.6377 (0.0018)***
$LNSIZE_{i,\tau}(-)$	-0.8083 (0.1588)
$MTB_{i,\tau}(-)$	-0.8793E-01 (0.6530)
$AGE_{i,\tau}(-)$	1.7895 (0.0275)**
$CPA_{i,\tau}(+)$	4.5811 (0.0016)***

$LEV_{i,\tau}(+)$	7.4229 (0.0345)**
$TV_{i,\tau}(+)$	-0.2094 (0.5204)
$CE_{i,\tau}(-)$	-11.0253 (0.0006)***
$ROA_{i,\tau}(-)$	23.2588 (0.0017)***
Ad-R ²	0.0183
Hausman Test	4.09 (0.9987)
Numbers of data	28,951

Note: $SALESRAT_{i,\tau}$: The sales variation for firm i between year τ . $ESGRATIO_{i,\tau}$: The ESG-related negative event ratio for firm i between year τ . $BOR_{i,\tau}$: The external block-holder ownership ratio of firm i in year τ . $IOR_{i,\tau}$: The institutional ownership ratio of firm i in year τ . $INDR_{i,\tau}$: The proportion of independent directors and supervisors to total board members in firm i in year τ . $MOR_{i,\tau}$: The managerial ownership ratio of firm i in year τ . The selection of the regression model is based on the results of the Hausman test. The values in parentheses represent p-values. Significance levels are denoted as follows: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

This study initially hypothesized that external block-holders, having no direct or indirect business dealings with the firm, would share similar objectives with general investors and therefore possess a practical monitoring function. Based on this assumption, a higher external ownership ratio was expected to be associated with fewer fluctuations in corporate sales. However, the regression model shows that the external block-holder ownership ratio has a coefficient of 17.2155 and a significant positive correlation at the 1% level, which contradicts the original hypothesis. Analysis of possible reasons: 1. External shareholders may maintain direct or indirect business relationships with the company or engage in non-contractual agreements, compromising their monitoring function and accountability. 2. The model may have omitted other critical factors that influence the monitoring effectiveness of external block-holders, resulting in an inability to demonstrate their actual impact on sales variation empirically. Due to the limitations in explanatory power of the coefficient of variation in this study, the observed result does not align with the original hypothesis.

This study selected the period from 2008 to 2024 to analyze the number of ESG-related adverse news events occurring annually among non-financial firms. Each year, the number of ESG-related adverse events per firm was recorded and divided by the total number of such events within the same industry, based on industry classifications from the Taiwan Economic Journal (TEJ). This ratio was used to assess the relative exposure of each firm to ESG incidents.

The study hypothesizes that a higher frequency of ESG-related adverse events is associated with greater variation in corporate sales. The regression results confirm this hypothesis, showing a coefficient of 0.6377 for the ESG negative event ratio, which is statistically significant at the 1% level. This finding is consistent with the expected direction of the relationship proposed by the study.

5. Conclusions

In summary, the empirical evidence underscores the strategic value of ESG integration for sustaining corporate sales performance. Firms proactively engage in ESG practices tend to experience greater sales stability and more resilient profitability, even after accounting for implementation costs. In particular, strong ESG performance is associated with fewer year-over-year sales fluctuations, which supports a firm's ability to maintain market share and customer confidence. This translates into a discernible competitive advantage, as companies with robust ESG credentials are better positioned to preserve their market position in the face of industry competition.

Critically, the study's findings highlight that a company's governance structure and risk management practices are integral to these outcomes. Sound corporate governance mechanisms create an environment of accountability that stabilizes sales performance. For example, when firms protect managers and directors (e.g., by purchasing directors' and officers' liability insurance), management can focus on operational effectiveness, improving profitability, and steadier revenues. Conversely, frequent ESG or CSR-related controversies were found to exacerbate sales volatility, as companies facing recurrent ESG incidents exhibit significantly larger swings in revenue. This detrimental effect of ESG lapses on sales underscores the importance of vigilant CSR risk management in safeguarding a firm's market standing.

Overall, these results indicate that robust ESG engagement – encompassing strong governance structures, proactive social responsibility, and protective measures for management – functions as a stabilizing force for corporate sales. By embedding ESG

principles into their core strategy, companies bolster their financial consistency and enhance market competitiveness, securing a more sustainable footing in their industries. The actionable insight for corporate leaders and stakeholders is clear: ESG investments and governance reforms are not merely ethical or compliance considerations, but tangible drivers of stable growth and competitive resilience.

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