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IMPACT OF SUSTAINABLE BUSINESS MODEL ON RETURN ON EQUITY IN COMPANIES IN CROATIA

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Abstract —Companies around the world recognize that sustainability is not merely a regulatory requirement or moral choice, but a source of competitive advantage. Every day, companies are shifting from a conservative to a sustainable business model. Return on equity (ROE) is considered a key gauge of a corporation's profitability and its ability to generate those profits efficiently. The main objective of this paper is to examine how the transition from a conservative to a sustainable business model affects ROE, while also analyzing the impact of company size, industry sectors, years and their interaction effects. This study utilized panel data for a random sample of 1,830 observations (230 Croatian companies over 6 years). A linear mixed model was used in the SPSS program to perform statistical analysis. The results show that the business model significantly influences ROE. Overall, the model indicates that business model, year, sector, company size, and their key interactions (particularly year-sector and multi-way interactions) significantly contribute to the variation in ROE. The main limitation of this study is a small and country-limited sample. Future research should focus on increasing the sample size in other European countries and examining additional accounting and market profitability indicators. ROE is rarely researched, especially in emerging market economies, and the main contribution of this paper is to fill this gap. The findings offer valuable implications for corporations, showing that implementing a sustainable business model can maximize shareholder wealth.

Keywords— conservative business model, environmental, social, and governance (ESG) activities, sustainable business model, return on equity (ROE)

INTRODUCTION

In today's evolving economic landscape, sustainability has shifted from a regulatory requirement or ethical imperative to a strategic source of competitive advantage. Businesses increasingly recognize that integrating sustainability into their operations is not merely about compliance or corporate social responsibility (CSR), but about capturing long-term value and maintaining relevance in a dynamic market. Nevertheless, companies rooted in traditional business models often perceive sustainability as a threat, particularly when competing with firms that are born sustainable. Sustainable business models (SBMs) aim to balance stakeholder needs, prioritize long-term outcomes, and complement economic performance with social and environmental impact (Mignon & Bankel, 2022). This sustainable theory confronts traditional economic theory, which maintains that "a firm's social responsibility is to increase profits" (Friedman, 1970). This dichotomy underscores the significance of evaluating how sustainability-oriented business model transformations affect key financial indicators, particularly return on equity (ROE). Environmental, Social, and Governance (ESG) activities determine the level of financial performance (Remo-Diez et al., 2023).

ROE is a measure of a company's profitability and efficiency in generating income from shareholder equity. A higher ROE often signals superior management performance and value creation. Despite its relevance, ROE has not been extensively examined in relation to sustainable business models (SBMs) transitions, highlighting a notable gap in the literature. As organizations shift from conservative models toward sustainable business frameworks, understanding the financial implications, especially on ROE, becomes critical. Investors can use ROE to estimate a stock's growth rate and the growth rate of its dividends. These two calculations are interdependent and can facilitate a more straightforward comparison between similar companies, thereby informing decisions. ROE is used to enhance investor confidence to manage quality and strategy (Kayakuş et al., 2023). The main objective of this study is to examine how transitioning from a conservative to a sustainable business model affects ROE. Furthermore, it evaluates how company characteristics, such as size, industry sectors, and years of experience, interact with this transition to influence ROE. The study aims to contribute empirical evidence to the debate on sustainability and financial performance, offering insights for managers, investors, and policymakers navigating the sustainability transition.

I. LITERATURE REVIEW

Sustainable business models represent a paradigm shift in how companies operate, aligning economic goals with social and environmental priorities. According to Stubbs and Cocklin (2008, p.103), SBMs are those in which "sustainability concepts shape the driving force of the firm and its decision making … [and] the dominant neoclassical model of the firm is transformed, rather than supplemented, by social and environmental priorities". This transformation challenges Friedman's (1970) classical assertion that a company's sole responsibility is to increase profits. SBMs emerge from a reconfiguration of traditional business model components, including value proposition, value creation and delivery, and value capture (Richardson, 2008). Unlike conventional models, SBMs integrate environmental and social dimensions into these core elements (Abdelkafi & Täuscher, 2016). Lashitew et al. (2020) argue that value capture in SBMs extends beyond financial gains to include societal and environmental benefits. This broader perspective appears to be driven by rising societal expectations (Preghenella &

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Battistella, 2021) and often requires a fundamental transformation in strategy and operations (Teece, 2010). However, transitioning to SBMs is rarely a linear or straightforward process. Companies may manage multiple business models simultaneously, which complicates the integration of sustainability (Berntsen et al., 2023). CSR serves as a strategic bridge connecting the triple bottom line, encompassing people, planet, and profit, to a cohesive SBM (Govindan et al., 2014).

ROE serves as a critical indicator of a company's profitability, offering insight into how effectively it transforms equity capital into net earnings. A higher ROE generally reflects superior management efficiency in leveraging equity to drive profit and business expansion. Mathematically, ROE is obtained by dividing net profit by shareholders' equity, which itself is the residual value after subtracting total liabilities from total assets. Hence, ROE effectively measures returns generated on net assets. Exceptionally high ROE values may not always signal optimal performance, they can stem from a disproportionately small equity base relative to net profit, implying elevated financial risk. Therefore, sector-specific benchmarking is advisable. A company that consistently reports ROE figures above its industry's average may be demonstrating superior managerial competence in utilizing capital. However, comparisons across industries must be approached with caution, as acceptable ROE thresholds differ widely depending on sectoral norms. For general evaluation purposes, many investors consider ROE below 10% subpar, whereas levels approximating the long-term S&P 500 average are deemed satisfactory.

In Croatia, specific statutory capital requirements further shape the ROE landscape. Limited liability companies (LLCs) must maintain a minimum equity of €2,500, while joint-stock companies are required to hold at least €25,000. In practice, many LLCs distribute the entirety of their net profits to shareholders, which can influence equity levels and, consequently, ROE outcomes. ROE that fluctuates markedly across accounting periods may be indicative of inconsistent financial reporting methods. Notably, a combination of negative net income and negative equity can artificially inflate ROE, producing a misleading signal. Net profit itself is derived by subtracting all operational, interest, and tax expenses from total net revenue. Corporate tax in Croatia is tiered: companies with annual revenues below €1 million are subject to a 10% profit tax rate, while those exceeding this threshold are taxed at 18%. When calculating average shareholders' equity for ROE assessment, the standard approach is to determine the arithmetic mean by subtracting the equity balance at the start of the period from the end balance and dividing the result by two.

Corporate sustainability assessed by ESG metrics, their relationship with financial performance, particularly ROE, remains contentious. While some studies report a positive link (Abdi et al., 2022; Ahmad et al., 2021; Broadstock et al., 2021), others find negative (Duque-Grisales & Aguilera-Caracuel, 2021; Ruan & Liu, 2021) or non-significant relationships (Nekhili et al., 2021). Mixed findings are often attributed to inconsistent methodologies (Orlitzky et al., 2003), indicator ambiguity (Margolis et al., 2011), and contextual factors (Laguir et al., 2021). Recent empirical research underscores this inconsistency. Rau and Yu (2023) observed that environmental and governance scores were negatively associated with ROE in Indian firms. Similarly, Firmansyah et al. (2023) reported that ESG disclosures had varying effects on ROE in Saudi Arabia, with governance disclosure negatively influencing ROE. Intezar et al. (2024) found ESG and its sub-components to have a mostly insignificant or negative impact on ROE. These findings align with earlier work by Krüger (2015), who also identified a negative relationship between governance performance and ROE. On the other hand, some scholars have shown more nuanced results. For example, Bruna et al. (2022) and Kumar et al. (2022) identified a curvilinear relationship between ESG and ROE, suggesting that moderate ESG investment may be optimal. Others, such as Shmelev and Gilardi (2025), argue that ESG scores may have a stronger correlation with ROE than with share price, given investors' increasing focus on stable, long-term returns. In Croatia, Mijoč (2024) identified a significant relationship between internal factors, such as debt, size, EBIT, and profitability indicators, including ROE, among IT firms. Similarly, Tekin (2022) showed that CSR influences ROE in Turkey's energy sector. Spitsin et al. (2024) highlighted that long-term growth strategies significantly enhance ROE, particularly for younger firms.

Despite diverse findings, the growing body of literature affirms the need for further investigation into how SBMs affect ROE, especially considering firm characteristics such as size, sector, and period.

Thus, this study sets the following hypothesis: H1: Transitioning to a sustainable business model leads to an increase in ROE, moderated by company characteristics such as industry sector, size over time.

II. METHODOLOGY

The primary objective of this study is to investigate how transitioning from a conservative to a sustainable business model influences ROE, while also analyzing the effects of company size, industry sector, year, and their interaction effects on ROE. To achieve this goal, a sample of 230 companies operating in Croatia over six years (2018-2023) was analyzed, yielding a total of 1,380 observations. In addition to examining the impact of the business model on ROE, the study explores how company size and industry sector contribute to ROE variation within the context of a specific business model. Statistical analysis uses a linear mixed model for panel data in SPSS. The mixed model is particularly suitable for this type of longitudinal data as it allows for the inclusion of both fixed effects (such as year or business model) and random effects (such as inter-company variability), thereby controlling for repeated measurements across time (Damrah et al., 2023). The research sample consists of 230 companies operating in Croatia. In terms of company size, 63% of the companies are large enterprises, 25% are medium-sized, 10% are small, and 1% are micro-enterprises. Regarding business model adoption, 28% of the companies still operate under a conservative business model, while the remaining 72% have transitioned to a sustainable business model. When examining the industry distribution of the sampled companies, the most represented sector is trade, accounting for 35% of the sample. It is followed by service industries at 24%, manufacturing at 21%, and information and communication technologies (ICT) at 8%. The construction and transportation sectors account for 6%.

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TABLE 1. MEAN ROE ACCORDING TO THE RESEARCH VARIABLE

YEAR	Mean ROE	Business model	Mean ROE	INDUSTRY SECTOR	Mean ROE	SIZE	Mean ROE
2018	.203	CONSERVATIVE	.214	PRODUCTION	.197	LARGE	.211
2019	.210			INF. AND COMM.	.246	MEDIUM	.275
2020	.230	SUSTAINABLE	.233	TRADE	.246	SMALL	.211
2021	.200			CONSTRUCT.	.203	MICRO	.249
2022	.213			TRANSPORT	.181		
2023	.308			SERVICES	.239		
Total	.227	Total	.227	Total	.227	Total	.227

Source: Author calculation

Table 1 presents the average ROE by year, business model, industry sector, and company size. The ROE present as a coefficient (not a percentage). From the results in Table 1, the highest average ROE is observed in 2023 (0.308), while the lowest is in 2021 (0.200). Although the difference in average ROE between the conservative and sustainable business models is not substantial, companies with a sustainable model have a slightly higher average ROE (0.233) compared to those with a conservative model (0.214).

Among the sectors, the highest average ROE is recorded in Trade and Information and Communication Technologies (0.246), while the lowest is in the Transport sector (0.181). Regarding company size, medium-sized enterprises show the highest ROE (0.275), while large and small companies both report lower values (0.211). Micro-enterprises also perform well, with an average ROE of 0.249.

III. Results and Discussion

Statistical analysis uses a linear mixed model on a panel dataset comprising 1,380 observations (230 companies over 6 years). The dependent variable in the model is ROE, a standard measure of company performance also used in prior research (Spitsin et al., 2024) to investigate the impact of adopting a sustainable business model. The model also includes control variables such as time (year), company size, and sector of activity.

The business model variable is coded as a binary indicator: companies implementing a sustainable business model have a value of 1, while those maintaining a conservative model have a value of 0.

Table 2 presents model selection criteria based on penalized likelihood measures. These measures use the "smaller-is-better" rule, where lower values indicate a better model fit.

TABLE 2. MODEL SELECTION CRITERIA

Information Criteria	Value
-2 Restricted Log Likelihood	-2484756.142
Akaike's Information Criterion (AIC)	-2.484.722.142
Hurvich and Tsai's Criterion (AICC)	-2.484.721.627
Bozdogan's Criterion (CAIC)	-2.484.618.526
Schwarz's Bayesian Criterion (BIC)	-2.484.635.526

The information criteria are displayed in smaller-is-better forms.

a. Dependent Variable: ROE.

Source: Author's calculation

Table 2 summarizes five model selection metrics based on penalized likelihood methods. All criteria aim to identify the best-fitting model while penalizing complexity to avoid overfitting. The AICC and AIC values are very close, indicating a

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large enough sample size for the AIC to be reliable. CAIC and BIC are higher ((indicating less damage), suggesting stronger penalization for complexity. Based on the "smaller-is-better" rule, the -2 Restricted Log Likelihood suggests the highest raw fit; however, among the criteria that incorporate complexity, AIC and AICC yield the most favourable values. These extremely low values suggest an excellent model fit, especially given the large dataset and high degrees of freedom. The slight differences between AIC and AICC indicate that overfitting is not a significant concern. All five metrics support a strong model fit.

Table 3 presents all model characteristics and interactions.

Table 3. TYPE III TESTS OF FIXED EFFECTS

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	9,613,204.637	2,422,489.913	0.000
Year	4	38,452,819.408	706,286.698	0.000
Business model (BM)	1	9,613,204.607	2,422,487.735	0.000
Industry Sector (IS)	3	29,596,362.168	783,755.653	0.000
Size	3	29,892,802.737	726,932.061	0.000
Year * BM	3	28,839,615.117	872,164.467	0.000
Year * IS	10	95,140,333.903	250,559.034	0.000
Year *Size	9	749,841.341	277,384.930	0.000
BM * IS	2	24,438,830.601	1,076,606.438	0.000
BM *Size	2	72,184,109.369	112,097.012	0.000
IS * Size	3	21,958,815.011	778,870.167	0.000
Year * BM * IS	5	60,726,158.244	498,185.500	0.000
Year* BM * Size	6	28,881	391,693.170	0.000
Year *IS * Size	9	65,915,880.486	276,783.838	0.000

a. Dependent Variable: ROE.

Source: Author's calculation

The Type III tests of fixed effects (Table 3) examine the unique contribution of each variable and interaction effects in a linear model where the dependent variable is ROE. The intercept value of 2,422,489.913 indicates a highly significant constant term. Years with a value of 706,286.698 show that ROE varies significantly over time. The business model with a value of 2,422,487.735 has a significant impact on ROE. The industry sector with a value of 783,755.653 shows that ROE differs significantly across industries. Company size, with a value of 726,932.061, significantly influences ROE. All listed two-way interactions show significant effects, indicating the relationships between variables are not purely additive. These interactions suggest that, for example, the impact of company size on ROE may vary across industries or years. Time does not substantially influence the variance of the Business model as much as company size. Activities have a significant impact over time on ROE. Activities significantly affect a business model. Activity-specific size effects contribute meaningfully to variance. Triple interaction highlights time-dependent sector effects of the business model. The influence of BM on ROE by size is not constant over time. ROE patterns by industry sector and size evolve. The results indicate that the effect of any single variable depends on its combination with others. All main one-way, two-way, and triple interactions are highly statistically significant ($p < 0.001$), indicating that each explains a substantial portion of the variance in ROE.

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Table 4 presents the estimation of covariance parameters.

TABLE 4. ESTIMATES OF COVARIANCE PARAMETERS

Parameter		Estimate	Std. Error
Residual		.275421[b]	0.0000000
Intercept	Variance	.000000[b]	0.0000000
Years	Variance	188776087.072600[b]	0.0000000
Business Model (BM)	Variance	1.370092E-073[b]	0.0000000
Industry Sector (IS)	Variance	880332217.3	0.966307
Size	Variance	61394436.279457[b]	0.0000000
Year * BM	Variance	3.898867E-053[b]	0.0000000
Year * IS	Variance	2077874475.834663[b]	0.0000000
year * size	Variance	1.000147E-053[b]	0.0000000
BMi * IS	Variance	1551710910.148665[b]	0.0000000
BM * size	Variance	123161.394548[b]	0.0000000
IS * Size	Variance	112282944.937326[b]	0.0000000
Year * BM * IS	Variance	.014438[b]	0.0000000
year * BM * Size	Variance	1.157453E-050[b]	0.0000000
Year * IS * Size	Variance	4.017889E-046[b]	0.0000000
BM * IS * Size	Variance	2014940384.069923[b]	0.0000000
Year * BM * IS * size	Variance	8059761536.295896[b]	0.0000000

a. Dependent Variable: ROE.

b. This covariance parameter is redundant.

Source: Author's calculation

Table 4 presents the estimated variance components for the random effects and residuals in the model, providing insight into the distribution of variability in ROE across different sources. Residual variance was estimated at 0.275421, indicating the portion of unexplained variability in ROE not accounted for by fixed or random effects. The intercept variance is reported as 0.000000, labelled as redundant, suggesting that the fixed structure of the model absorbed it or that there is no variance across the levels considered. The analysis of random effects year (188,776,087.07) shows high variability across years, indicating ROE shifts significantly over time. The business models exhibit negligible variance (1.37E-73), suggesting minimal random fluctuation at this level. The industry sectors (880,332,217.31) show a significant variance, indicating that they are a primary source of ROE variability. Size-based random variation (61,394,436.28) contributes meaningfully to ROE differences. Analyzed two-way interactions for year x Business models (3.90E-53) show that time does not substantially alter the variance of business models. The interaction year × Industry sectors (2,077,874,475.83) is substantial, indicating that industry sectors vary significantly over time in their effect on ROE. Interaction year x size (1.00E-53) shows negligible variance. The business model x Industry sector (1,551,710,910.15) shows significant interaction and strategic roles differ considerably by industry. Business models × size (123,161.39) show moderate variance. Industry sectors by size (112,282,944.94) show that industry-specific size effects contribute meaningfully to variance. In the analysis of the Three-Way Interaction, the year x BM x Industry sectors (0.0144) is minimal, but not zero. Year x BM x Size (1.16E-50) essentially no added variance. The year x industry sector x size (4.02E-46) interaction is minimal. BM x Industry sector x size (2,014,940,384.07) indicates a high level of interaction or a key interaction in explaining variability. A four-way interaction (year * BM * Industry sector * size) shows very high variance (8,059,761,536.30). This four-way interaction suggests a complex, context-sensitive interplay of business models, years, industry sectors, and company size in influencing ROE.

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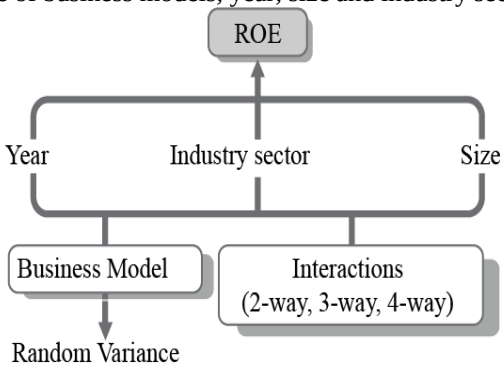
Conceptual Model Structure influence of business models, year, size and industry sectors on ROE, as presented in Graph 1.



Legend:
ROE: Dependent variable
Year, Industry Sector, Size: Key grouping (random) factors
Business Model: Fixed effect (Sustainable vs. Conservative)
Interactions: 2-way, 3-way, and 4-way combinations among variables
Random Variance: Captures unexplained variability

Graph 1. Conceptual Model Structure
Source: Author

The model results in Graph 1 strongly demonstrate that all main effects and nearly all interaction effects significantly influence ROE. Most main effects and two-way interactions make meaningful contributions to variance in ROE. The four-way interaction has the largest variance estimate, highlighting the importance of considering multidimensional interactions in corporate performance modelling. Graph 1 illustrates a comprehensive structure that captures variance across main and interaction effects. High-dimensional interactions in the model reveal complexity often masked in traditional models.

Based on the above, H1: Transitioning to a sustainable business model leads to an increase in ROE, moderated by company characteristics such as industry sector, size over time, is confirmed.

The findings highlight the dynamic and multifactorial nature of profitability, shaped by years, business model, industry sector and company size. Most importantly, the business model has a clear and significant effect: companies that have adopted a sustainable business model consistently achieve higher ROE than those adhering to a conservative model. This model supports the growing evidence that sustainability-oriented strategies are not only environmentally and socially beneficial but also economically advantageous. Companies that adopt sustainable strategy outperform those with conservative models, both statistically and financially. This finding supports the strategic case for sustainability-driven business transformation. Medium-sized enterprises consistently achieve better ROE than both small and large firms, suggesting optimal resource efficiency at intermediate scale levels. Sectoral context plays a critical role. Construction is the only sector with a positive and statistically significant ROE, indicating it may offer strategic advantages under specific models. ROE varies significantly over time, highlighting the importance of incorporating temporal dynamics in strategic and financial modelling. Two-way, three-way, and especially four-way interactions (Year × Business Model × Industry Sector × Size) significantly contribute to the variation in ROE. This interaction underscores the nonlinear, context-dependent, and dynamic nature of financial performance.

While this study finds that sustainable business models significantly enhance ROE, particularly through complex, multi-way interactions involving industry sector, company size, and time, other studies, such as Firmansyah et al. (2023) and Rocha et al. (2024) report mixed or even negative associations between ESG dimensions and ROE, specifically, Firmansyah et al. (2023) find that environmental disclosure positively affects ROE, however, social and governance disclosures have insignificant or negative impacts, while Rocha et al. (2024) conclude that ESG and social responsibility scores generally correlate negatively with financial performance. In contrast, the current study highlights that the strategic integration of sustainability, beyond ESG metrics and combined with contextual variables, offers a more precise and robust explanation of ROE variability, aligning more closely with Mijoč (2024), who identifies a significant relationship.

The model presented in this study identifies that contextual complexity, rather than ROE being merely affected by ESG metrics, emerges from interactions among business models, sector, time, and size.

In conclusion, adopting a sustainable business model offers not only long-term resilience but also statistically and economically superior financial outcomes. The evidence suggests that companies aiming to optimize ROE must consider a multidimensional approach, factoring in their size, industry sector, and temporal context when formulating strategic directions through their business model.

IV. CONCLUSIONS

The model results show that strategic orientation through the business model significantly influences ROE. Specifically, sustainable companies outperform conservative ones, both statistically and economically. This finding suggests that adopting

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sustainability-oriented strategies may lead to superior financial outcomes, while conservative approaches may be associated with systemic underperformance. The model demonstrates that a company cannot create a business model in isolation. The effectiveness of a business model is contingent upon the company's size, industry sector, and prevailing economic conditions over time. Tailored, context-sensitive strategies are essential for sustained performance. The presented model is more complex in its interaction structure, uniquely integrating multi-way interactions to explain contextual ROE variability, while other mentioned studies focused on ESG dimensions.

The main limitation of this study is a small and country-limited sample. Future research should focus on increasing the sample size in other European countries and examining additional accounting and market profitability indicators. ROE is rarely researched, especially in emerging market economies, and the main contribution of this paper is to fill this gap. The four-way interaction is particularly novel. The findings offer valuable implications for corporations, regulatory bodies and policymakers, providing practical guiding elements that facilitate the implementation of a sustainable business model that maximizes shareholder wealth.

Businesses recognize that sustainability is not merely a regulatory requirement or moral choice, but it is becoming a source of competitive advantage. A conclusion may review the main points of the paper, but it should not replicate the abstract. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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