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A Study on the Antecedent Grouping Pattern of ESG Decoupling in New Energy Vehicle Manufacturing Companies

-- Based on QCA And NCA Methods

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Abstract: This study explores the decoupling phenomenon of listed companies in the new energy vehicle manufacturing category in terms of ESG (environmental, social, and corporate governance) by using fuzzy set qualitative comparative analysis (fsQCA) and necessity condition analysis (NCA) methods, and identifies four different groupings. These groupings reveal the complexity and diversity of firms' ESG performance and disclosure, including high gearing and low environmental commitment, high management compensation and low social responsibility, high media attention and selective disclosure, and high market competition and inadequate governance. The results of the study show that financial pressure, management incentives, media attention and market competition all significantly affect firms' ESG behavior. Based on this, policy and management recommendations are proposed, such as strengthening the regulation of ESG disclosure, incorporating ESG performance assessment in executive incentives, and balancing short-term financial goals with long-term sustainable development. Although this study reveals the complexity of ESG decoupling in new energy automobile manufacturing firms, the limitations of data source, sample scope and methodology still exist. Future research should expand the sample scope, conduct dynamic analysis, and synthesize multiple methods to deepen the understanding of corporate ESG decoupling behavior and provide scientific guidance for management and policy making.

Keywords: Corporate ESG decoupling, fsQCA and NCA, Grouping analysis, Financial distress that.

1. Introduction

In 2022, General Secretary Xi Jinping proposed in the report of the 20th Party Congress to "synergize carbon reduction, pollution reduction, greening and growth, and promote ecological priority, conservation and intensification, green and low-carbon development". In the transition to sustainable development, the scope of environmental regulation has deepened and widened, enterprises are required or guided to transform, facing the dilemma of environmental protection and economic demands, ESG decoupling behavior has become a "double carbon" to achieve the construction of ecological civilization and the discordant note, such as the new energy in May 2022, which advocates the concept of green mobility. For example, in May 2022, BYD, a new energy company that advocates the concept of green mobility, exposed the Changsha "Emission Gate" incident and other false environmental protection phenomena.

The above content enriches and deepens people's understanding of the drivers of ESG decoupling of listed companies and expands many useful research ideas, but there are still the following shortcomings; most of the existing research focuses on a single factor affecting the decoupling of corporate ESG, i.e., the causality of any single factor with the decoupling of corporate ESG, and there is no mention of the linkage effect between the factors to determine whether it will have an impact on the decoupling of corporate ESG. In addition, few scholars have combined fsQCA and NCA to explore the causal relationship of corporate ESG decoupling.

2. Rationale and Modeling Framework

2.1. Theoretical Foundations

The fraud triangle theory is a widely used theoretical framework designed to reveal the nature of fraudulent behavior. According to this theory, fraud is composed of three main elements: pressure, opportunity and self-rationalization. In the field of environmental information disclosure, fraudulent behavior is usually manifested as "inconsistency between words and deeds" and "selective disclosure", which are regarded as fraudulent behaviors. Subsequently, researchers began to introduce the fraud triangle theory into the field of ESG (environmental, social and corporate governance) decoupling research.

Based on this, this paper argues that fraudulent corporate decoupling behavior is also driven by three layers of pressure, opportunity and rationalization: at the level of pressure, institutional theory suggests that organizations are faced with three types of institutional pressures: coercive, normative and imitative; at the level of opportunity, the problem of "moral hazards" provides "opportunities to exploit" corporate violations; at the level of self-rationalization, the top echelon theory suggests that executives with weak environmental awareness tend to rationalize corporate violations, increasing the risk of corporate environmental violations. At the level of opportunity, the problem of "moral hazard" provides "opportunities" for corporate violations; at the level of self-rationalization, the top echelon theory suggests that executives who are less aware of environmental protection tend to rationalize corporate violations, increasing the risk of

corporate environmental violations.

2.2. ESG Decoupling and Influencing Elements of New Energy Automobile Manufacturing Industry, The

2.2.1. Definition and Concepts of ESG Decoupling in Firms, the

Corporate ESG decoupling refers to the inconsistency between a company's public commitment to environmental, social and corporate governance (ESG) and its actual behavior.

2.2.2. Scope of definition of impact factors

The first step in group theorizing is to define the scope. FURNARI13 et al. proposed a method to simplify the number of antecedent conditions by complicating them based on anchors.1 This paper uses the stress level and the opportunity level as well as the self-rationalization level as the scope definition based on the fraud triangle theory and the characteristics of decoupled elements of ESG. In this paper, based on the theory of the fraud triangle and the characteristics of the decoupled elements of corporate ESG, the pressure level, the opportunity level, and the self-rationalization level are used as anchors for scoping.

3. Research Design

3.1. NCA and fsQCA Hybrid Approach

Fuzzy set qualitative comparative analysis (fsQCA) is a research method based on Boolean logic and algebraic testing of complex causal relationships between conditions.

3.2. Sample Selection and Data Sources

In this study, 250 A-share listed companies in the new energy automobile manufacturing category are randomly selected as the research samples, excluding the samples with missing data, ST*, etc., and the final sample size is 226.

3.3. Interpretation and Calibration of Variables

Corporate ESG decoupling: In this paper, we refer to the practice of Wang Yimin26 et al. The difference between the two data matches is standardized by identifying the RKS score as "doing" and the CNRDS score as "saying". The higher the value, the higher the degree of inconsistency or deviation between the "doing" of CSR practices and the "saying" of CSR reports.

Corporate financial distress; this paper is based on the Z-Score model developed by Edward Altman, where an Altman Z-score close to 1.8 indicates that the company may be about to go bankrupt, while a score closes to 3 indicates that the company is in a stable financial position.

Table 1. Calibration and descriptive statistics for outcome and condition variables

Variables	Anchors			Descriptive analysis			
	Not affiliated at all	Intersections	Full affiliation	Mean	Standard deviation	Max	Min
CHAZHI	-0.290565	1.34721	1.97882	1.1284875	0.903392578	2.03613	-0.67671
HHI	0.0575789	0.0661925	0.0919083	0.070905875	0.013651133	0.092119	0.053282
MEDIA	1.91585	3.22917	3.90516	3.11756125	0.774095149	3.97029	1.60944
ROA	0.0206083	0.044033	0.68819	0.161867875	0.347844081	1.02167	0.020035
SALARY	507126.4	1157885	3268637.75	1494277.38	1137468.939	4028304	420556
LEV	0.305045	0.625843	0.739797	0.57563625	0.168370164	0.754202	0.249413
R-STRESS	0.487968	2.486328	10.0883046	3.590483642	-1.23457607	44.066975	-1.908796

4. Findings of the Study

4.1. Individual Conditional Necessity Analysis

This paper analyzes the necessity of individual antecedent conditions based on the NCA package in R software. First, the effect size of the antecedent conditions is analyzed. The effect size is the ratio of the upper limit region to the range, which indicates the degree of constraint on the outcome conditions, and takes the value range of 0~1. The antecedent conditions in this paper are all of continuous type

values, so the ceiling regression (CR) analysis technique was chosen for the measurement. Before analyzing, this paper converts the original values of all the conditions into pooled affiliation scores. Based on the judgment criteria of necessary conditions given by DUL et al., the effect size (d) of necessary conditions was greater than 0.1 and significant at the 5% level ($p < 0.05$).

Table 2. The results of the analysis of the necessary conditions for the NCA method

Conditions	Methods	Precision	The ceiling area	Scope	d	p-value
HHI	CR	87.5	0.006	0.88	0.006	0.091
MEDIA	CR	75	0.124	0.88	0.124	0.033
ROA	CR	75	0.008	0.75	0.008	0.212
SALARY	CR	100	0.001	0.94	0.001	0.008
LEV	CR	75	0.132	0.88	0.132	0.01
R-STRESS	CR	100	0.159	0.94	0.159	0.007
Note; 1) Conditional on calibrated fuzzy affiliation value; 2) 0≤d<0.1 is low level; 3) The number of resampling of permutation test (permutation test) in NCA analysis is 10,000 times						

Second, the bottleneck level of antecedents is reported. The bottleneck level analysis can show what level of antecedent conditions are required to achieve a particular level of results. Based on the results of the bottleneck level analysis in Table

3, it can be seen that the level of influence decoupling (variable affiliation scores greater than 0.5) has to be achieved.

Table 3. The results of the bottleneck level (%) analysis of the NCA method

The degree of decoupling	HHI	MEDIA	ROA	SALARY	LEV	R-STRESS
0.000	NN	NN	NN	NN	NN	NN
0.100	0.053	NN	NN	NN	NN	NN
0.200	0.103	NN	NN	NN	0.003	0.041
0.300	0.161	0.062	NN	NN	0.109	0.113
0.400	0.214	0.173	NN	NN	0.215	0.258
0.500	0.268	0.283	NN	NN	0.321	0.378
0.600	0.322	0.393	0.051	0.049	0.427	0.452
0.700	0.376	0.504	0.17	0.161	0.533	0.513
0.800	0.43	0.614	0.289	0.255	0.639	0.659
0.900	0.483	0.725	0.408	0.379	0.745	0.741
1.000	0.537	0.835	0.527	0.463	0.851	0.877
Note: 1) analytical method is CR; 2) NN means "not necessary".						

The necessity of individual conditions based on the fsQCA method is analyzed, and the results are shown in Table 4. The consistency scores of the six antecedent conditions are less than 0.9, which indicates that none of the antecedent conditions constitutes a necessary condition affecting the decoupling of firms' ESG.

4.2. Sufficiency Analysis of Conditional Configurations

Considering the number of 226 cases and the relevant literature on consistency threshold setting, this paper set the consistency threshold at 0.80 and the frequency threshold at 1. All cases were included in the analysis.

Table 4. necessity analysis

Conditional variables	Tall		Non-high	
	Consistency	Coverage	Consistency	Coverage
HHI	0.643183	0.658139	0.686110	0.574419
~HHI	0.584092	0.694595	0.591666	0.575676
MEDIA	0.809092	0.868966	0.305555	0.335632
~MEDIA	0.443182	0.413699	0.841665	0.830137
ROA	0.502273	0.706296	0.380277	0.43752
~LONG	0.600001	0.541983	0.744721	0.5504
SALARY	0.175000	0.77	0.063889	0.23
~SALARY	0.825001	0.518571	0.836109	0.481429
LEV	0.854547	0.842857	0.352777	0.388095
~LEV	0.315910	0.481579	0.816665	0.773684
R-STRESS	0.893182	0.865	0.365000	0.335000
~R-STRESS	0.286819	0.445	0.824998	0.555
Note: "~" stands for absence.				

Table 5. grouping of high ESG scores and non-high ESG scores

Conditional variables	High ESG scores				non-high ESG scores	
	P1	P2	P3	P4	NP1	NP2
Market competition (HHI)	●	⊗	⊗	●	●	⊗
Media attention (LN)	●	●	●	●	⊗	⊗
Net profit margin on total assets (ROA)	●	●	●	●	⊗	⊗
Top management remuneration (SALARY)	⊗	⊗	⊗	⊗	●	●
Gearing ratio (LEV)	⊗	●	●	●	⊗	●
Financial distress (R-STRESS)	⊗	⊗	⊗	●	⊗	⊗
Consistency	0.880909	0.918033	0.943244	0.926413	0.957752	0.974951
Original coverage	0.252273	0.0454546	0.125	0.118182	0.569721	0.297222
Unique coverage	0.0431819	0.254546	0.125	0.118182	0.344722	0.0722221
The coverage of the overall solution	0.54091				0.641943	
The consistency of the overall solution	0.91714975				0.9663515	
Note: ● indicates presence; ● indicates presence of core conditions; ⊗ indicates absence; ⊗ indicates absence of core conditions						

4.3. Conclusion and Discussion

4.3.1. Configuration naming

The third step in the theorization of grouping is naming, which requires the construction of a name that can convey its connotation. This paper combines the concepts proposed in the grounded theory linkage stage and the differentiated roles of each mechanism, and names group P1 as "Pressure Coordination--Opportunity Enabling", group P2 as "Pressure Leading--Multiparty Participation", and group P3 as "Pressure Enabling--Multiparty Participation". --P2 is named as "Pressure-led - multi-party participation type", P3 is named as "Pressure empowerment - rationalization push type", and P4 is named as P4 is named as "Pressure Coordination - Insufficient Opportunity Type". In the following, the theoretical connotation and corresponding cases of each group are analyzed.

4.3.2. High ESG decoupling configuration analysis

Mode 1, Pressure Integration - Opportunity Booster (P1) The theoretical connotation of P1 is that in the face of market pressure, an enterprise is able to utilize all kinds of internal resources and external opportunities in an integrated manner, so as to turn pressure into motivation and achieve sustainable development and success of its business. Specifically, this grouping reflects the ability of an enterprise to not only meet challenges, but also to capitalize on opportunities to accelerate growth in a highly competitive environment.

Mode 2, Pressure-led - multi-party participation (P2 grouping) The theoretical connotation of the P2 grouping mainly lies in the fact that enterprises facing market pressures, through multi-party participation and cooperation, to jointly resolve pressures and meet challenges, so as to realize the sustainable development and success of the business. The P2 configuration of the enterprise focuses on the cooperation and collaboration with different stakeholders, including suppliers, partners, customers, government departments, industry associations and so on.

Mode 3, pressure empowerment - rationalization and promotion (P3) The theoretical connotation of the P3 group is that enterprises facing market pressure, through rationalization of operations and promotion of core business, empower themselves to enhance competitiveness and adapt to market changes. By reducing costs and improving efficiency, they can maximize the use of resources and maximize benefits.

Mode 4, pressure integration - insufficient opportunities (P4) The theoretical connotation of the P4 grouping mainly lies in the fact that enterprises facing market pressure are relatively lacking in the ability to utilize opportunities, and need to respond to the challenge by integrating resources and looking for new opportunities for development. Enterprises of the P4 grouping may have insufficient integration and utilization of resources, and internal resource allocation is unreasonable, leading to waste of resources and inefficiency. P4 enterprises may have under-integrated and under-utilized resources, and internal resource allocation is not reasonable, leading to waste of resources and inefficiency.

4.4. Further Analysis

As shown in Table 5, there exist two histogram paths with non-high ESG scores. The histograms NP1 and NP2 indicate that in the absence of media attention, average executive compensation, financial distress, and net profit margin on total assets, firms do not have a high degree of ESG decoupling even with market competition and gearing.

4.5. Robustness Test

In this paper, we use 1 method for robustness testing. Increase the consistency threshold. In this paper, the consistency threshold is raised from 0.8 to 0.85, and three groupings that are consistent with the original groupings are obtained. In summary, the research results of this paper have strong robustness.

Table 6. Robustnesscheck

Conditional variables	Adjustment of the calibration point				Raising the consistency threshold		
	SP1A	SP2A	SP3A	SP4A	SP1B	SP2B	SP3B
Market competition (HHI)	●	⊗	⊗	●	⊗	⊗	●
Media attention (LN)	●	●	●	●	●	●	●
Net profit margin on total assets (ROA)	●	●	●	●	●	⊗	●
Executive compensation (SALARY)	⊗	●	⊗	⊗	⊗	●	⊗
Gearing ratio (LEV)	⊗	●	●	●	●	●	●
Financial distress (R-STRESS)	⊗	⊗	●	●		●	●
Consistency	0.825	0.988372	0.978421	0.98512	0.918033	0.965578	0.967998
Original coverage	0.211539	0.181624	0.117522	0.132479	0.254546	0.125	0.118182
Unique coverage	0.106838	0.0769233	0.106838	0.121795	0.254546	0.125	0.118182
the coverage of the overall solution	0.527779				0.501374		
the consistency of the overall solution	0.918216				0.956332		

5. Conclusions and Implications of the Study

5.1. Conclusions of the Study

The results of the study show that: 1) financial distress, media attention, gearing is a necessary condition affecting the decoupling of corporate ESG, and its importance is media attention, gearing, financial distress in descending order; 2) there is a "pressure-integrated-opportunity-assisted", "pressure-led-multi-participation", "pressure-enabled-rationalization-promoted", "pressure-led-multi-party participation type", "pressure-enabled - rationalization of the main push type", "pressure coordination-opportunity insufficient type" 4 types of high ESG decoupling of the antecedent group; 3) there are 2 types of non-high ESG decoupling of the antecedent group, presenting the following two characteristics; first, the rationalization of the level of the

elements of poor performance, and second, the rationalization of the level of the elements of poor performance, and second, the rationalization of the level of the elements of poor performance, and second, the rationalization of the level of the elements of poor performance, and second. The first is that the rationalization level does not perform well, and the second is that in the absence of the pressure level and the opportunity level, even if the rationalization level works, it does not lead to a high degree of ESG decoupling in the enterprise.

5.2. Research Contributions

This study explores the different groupings of listed companies in the new energy vehicle manufacturing category in the phenomenon of ESG (environmental, social, and corporate governance) decoupling by applying fuzzy set qualitative comparative analysis (fsQCA) and necessity condition analysis (NCA), revealing the impact of the complex interaction of multiple factors on the ESG behaviors of companies. The following are the main contributions of this study.

Innovative use of multi-method synthesis

Combining fsQCA and NCA methods: This study is the first to combine fsQCA and NCA methods for analyzing ESG decoupling phenomenon of listed companies in new energy automobile manufacturing. fsQCA method can reveal the complex effects of different combinations of conditions on the results, while the NCA method can identify the necessary conditions.2. Deepening the understanding of ESG behaviors of the new energy automobile manufacturing industry

5.3. Research Limitations and Prospects

There are sample limitations in this paper: the sample of this study is limited to listed companies in the new energy automobile manufacturing category, which may limit the broad applicability of the findings. The ESG decoupling behaviors of other industries or unlisted companies may have different characteristics and motivations, and the findings may not be directly generalized to these areas.

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