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MODELING OF ECONOMIC SECURITY INDEX CALCULATION FOR TENCENT COMPANY

Economic Security (ES) refers to the ability of an organization to ensure the stability and sustainability of its business activities, assets, productive capacity, and strategic objectives in the face of internal and external threats. Specifically, economic security involves many fields such as financial health, information security, technical security, legal compliance, and market security.

While economic security and financial security are often used interchangeably, they represent distinct concepts that are interrelated but not synonymous. Financial security primarily refers to a company's ability to meet its financial obligations, such as paying off debts, managing cash flow, and maintaining [1]. On the other hand, economic security takes a broader perspective, encompassing all factors that ensure the company's ability to developing in a stable environment [2].

This study examines the factors influencing the Economic Security Index (ESI) of Tencent, one of China's leading technology companies, by analyzing five key dimensions: Financial Health, Market Performance, Technological Innovation, Management Efficiency, and External Policy & Legal Environment. Using regression analysis, this research identifies the significant relationships between these dimensions and the ESI. The study based on theoretical investigations [3-6].

This study uses quantitative research methods to evaluate the economic security of enterprises through numerical data and statistical analysis. Quantitative methods can provide concrete and actionable measurement results and facilitate the examination and analysis of the relationship between different variables. Through quantitative analysis, this study can reveal all dimensions of enterprise economic security in a data-driven way, and draw conclusions with empirical basis.

The addition model is used to comprehensively evaluate the various dimensions of enterprise economic security, adding up different risk factors (such as financial stability, market competitiveness, technological innovation, etc.) according to a certain weight to get a comprehensive economic security score. These factors may include financial health indicators, market performance, ability to innovate, etc. In this study, the addition model will serve as a preliminary assessment tool, providing a comprehensive score based on different risk dimensions [6]. The basic formula of the addition model is:

$$ES = \sum_{i=1}^{n} w_i \cdot X_i, \quad (1)$$

where ES – the composite economic security score of the enterprise;

w_i – the weight assigned to the i-th risk factor, reflecting its relative importance in the overall economic security evaluation;

X_i – the measurement value of the i-th risk factor, such as financial ratios, market share, technological capability, innovation index, etc;

n – the total number of risk factors considered in the evaluation model.

For each economic security indicator X_i ,the data will be standardized to bring them into the same scale. Common methods of standardization include min-max normalization or Zscore normalization. Once standardized, these values can be directly used in the weighted sum calculation. The weights w_i are a crucial aspect of this model. They can be determined through expert assessments, historical data analysis, or multi-criteria decision-making methods, such as the AHP method or the Delphi method. The resulting composite score ES provides an overall indication of the economic security status of the enterprise. The advantage of the additive model is its simplicity and intuitive nature, making it easy to understand and apply. However, its limitation lies in the assumption that the risk factors are independent of each other, which may not accurately reflect the interdependencies between these factors in real-world situations.

In this study, measurable Items refer to the specific indicators or variables used to assess the economic security of an enterprise. These measurable items are derived from five aspects of the enterprise, including its financial status, market performance, technological innovation, management efficiency and external policy and legal (Variables in Table 1). Financial health is the foundation of an enterprise's economic security, reflecting the stability and flexibility of the company's short-term and long-term debt repayment capacity. Market performance reflects the enterprise's competitiveness within the industry and its ability to survive in the external environment. Technological innovation capacity is an essential factor for long-term development and adaptability to market changes. Management efficiency involves the effectiveness of internal operations, including the stability of leadership and the company's ability to adapt. The external policy and legal environment refers to the impact of government policies and regulatory compliance on the company's operations.

Table 1 –Variables and measurable items for Economic Security index (ESI) calculation

Variable	Measurable Item and Code	Definition	Data Source	Measurement Method
Financial Health	Current Ratio (F1)	The ratio of current assets to current liabilities, measuring short-term solvency.	Company Financial Statements	Calculate the ratio of current assets to current liabilities
	Quick Ratio (F2)	The ratio of current assets minus inventory to current liabilities, excluding inventory.	Company Financial Statements	Calculate the ratio of current assets minus inventory to current liabilities
	Debt to Asset Ratio (F3)	The ratio of total liabilities to total assets, indicating debt levels.	Company Financial Statements	Calculate the ratio of total liabilities to total assets
Market Performance	Market Capitalization (M1)	The product of stock price and total number of shares, measuring market valuation.	Stock Market Data	Obtain stock price and total number of shares
	Stock Price Volatility (M2)	The extent of fluctuations in stock price, indicating market risk.	Stock Market Data	Calculate the standard deviation of stock prices
	Market Share (M3)	The percentage of the market occupied by the company.	Industry Reports, Market Data	Calculate the company's market share in its industry
Technological Innovation	R&D Expenditure (T1)	The amount spent by the company on research and development, reflecting emphasis on innovation.	Company Financial Reports, Annual Reports	Use R&D expenditure data
	Number of Patents (T2)	The number of patents held by the company, reflecting its innovation capability.	Patent Database	Query the number of patents
	Technology Investments (T3)	Investments in technology equipment and systems, indicating commitment to technological progress.	Company Annual Reports	Obtain data from annual reports or investment announcements
Management Efficiency	Leadership Stability (ME1)	The frequency of changes in senior management personnel.	Company Annual Reports, News Reports	Track the frequency of management changes
	Organizational Structure and Decision-Making Efficiency (ME2)	The rationality of organizational structure and decision-making efficiency.	Company Internal Data, Management Interviews	Obtain data through surveys or expert evaluations
External Policy and Legal	Compliance (E1)	Whether the company complies with relevant laws and regulations.	Legal Documents, Industry Reports	Check the company's legal compliance
	Government Policy Changes (E2)	The impact of government policy changes on company operations.	Government Announcements, Industry Reports	Obtain data from policy reviews or government reports

Each measurable item will be quantified and used to reflect different latent variables such as financial health, technological innovation capacity, and market

competitiveness. By analyzing these measurable items, we aim to provide a more comprehensive and precise evaluation of the enterprise's economic security level (Table 1). At table 1 also codes of measurable items is represented. These codes will be used in modeling of ESI calculation.

In this study five hypothesis (that each variable is positively correlated with economic security level) will be tested:

– H1: there is a positive relationship between the financial health of an enterprise (measured by current ratio, quick ratio, and debt to asset ratio) and its overall economic security;

– H2: there is a positive relationship between market performance (measured by market capitalization, stock price volatility, and market share) and the economic security of the enterprise;

– H3: there is a positive relationship between an enterprise’s technological innovation (measured by R&D expenditure, number of patents, and technology investments) and its overall economic security;

– H4: there is a positive relationship between management efficiency (measured by leadership stability and organizational structure) and the economic security of the enterprise;

– H5: there is a positive relationship between compliance with external policies and laws and the economic security of the enterprise.

Data availability and quality are crucial factors that can significantly influence the outcomes of empirical analysis. One of the primary challenges in this study is ensuring that the data required for analysis is both available and accurate. While much of the financial, market, and operational data will be drawn from publicly available company reports, stock market data, and industry publications, there are several issues related to data quality and completeness that must be addressed:

– data completeness is a major concern, as not all the variables of interest may be available for every enterprise. For example, smaller or privately owned companies may

not disclose detailed financial information, or there could be gaps in data for certain years or quarters, which would create missing values in the dataset;

– some of the data in this study, such as management efficiency or leadership stability, will be sourced from qualitative assessments. These variables are inherently subjective and may suffer from biases, as expert opinions and interviews often reflect individual perspectives rather than objective measures;

One primary limitation is the assumption of linear relationships in methods such as multiple regression analysis and path analysis. These methods are based on the premise that the relationships between variables are linear. However, in reality, many relationships in business and economics are non-linear or involve complex interactions. For instance, the relationship between financial health and economic security may not always be a straight line, and treating it as such could result in oversimplification or misinterpretation of the data. While regression analysis can still identify patterns, non-linear interactions might require alternative methods or transformations.

Another limitation relates to the issue of causal inference. Multicollinearity is also a concern in multiple regression analysis, especially when independent variables are highly correlated with one another. For example, financial indicators like the current ratio, quick ratio, and debt-to-asset ratio may exhibit high intercorrelation, making it difficult to estimate the individual effects of each variable on economic security. High multicollinearity can cause unstable estimates and lead to unreliable results.

Modeling of Economic Security Index is provided on data of Tencent, a leading technology company in China. It is large multinational, which operates in various international markets.

This study establishes the evaluation system for the Tencent Economic Security Index based on the principle of multidimensional comprehensive assessment. It integrates various aspects, including financial stability, market performance, technological innovation, management efficiency, and the external policy environment. To ensure scientific accuracy and objectivity, the entropy method is employed to

calculate the weight of each index objectively, while the analytic hierarchy process (AHP) is used to refine the weights of complex dimensions. Standardized methods are applied to process the data, eliminating the impact of differing index dimensions and enabling all data to be evaluated on a uniform scale. The comprehensive score is then determined using a weighted average method. Additionally, the evaluation system incorporates a dynamic update mechanism to adapt to shifts in the market and policy environment, ensuring real-time relevance and adaptability of the results.

Matrix at Table 2 represents the pairwise comparisons of different dimensions for evaluating the economic security of Tencent. Each dimension is compared against others based on their relative importance, with the scale ranging from 1 (equal importance) to 9 (extremely more important).

Table 2 – Pairwise comparisons of five variables for evaluating the economic security of Tencent Company

	Financial Health (A1)	Market Performance (A2)	Technological Innovation (A3)	Management Efficiency (A4)	External Policy & Legal Environment (A5)
A1	1	3	5	1/3	1/5
A2	1/3	1	3	1/5	1/7
A3	1/5	1/3	1	1/7	1/9
A4	3	5	7	1	3
A5	5	7	9	1/3	1

Due to represent in Table 2 data it is shown, that A4 (Market Efficiency) is the most important variable among five analyzed. The next important is A5 (External Policy & Legal Environment), on third position is A1 (Finance). Technological Innovation is less important.

On the base of pairwise comparisons the weights of each variable A1-A5 were defined (Figure 1). The weight values reflect these importance levels, with variable 4 and variable 5 holding the highest weights (41.44% and 34.07% respectively), indicating they significantly influence the final economic security score.

The Economic Security Index (ESI) is determined by allocating weights to each indicator according to its significance in enhancing the enterprise's overall economic security. These weights are shown at Fig 1.

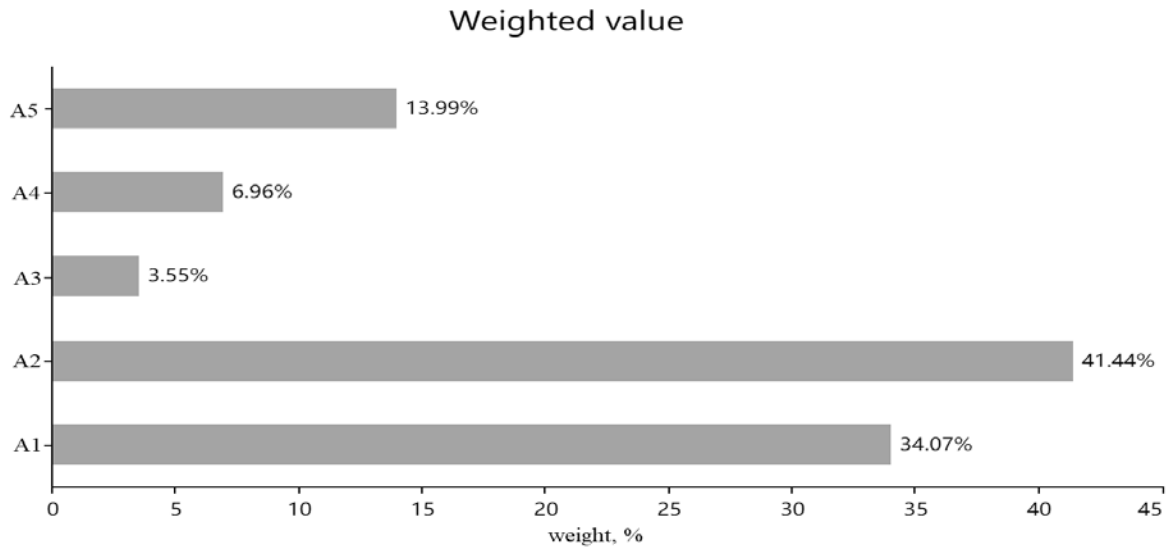

Figure 1 – Weighted value of each variable

After assigning weights, the standardized value of each indicator is multiplied by its respective weight to produce a weighted score. The final ESI for each period is then calculated by summing these weighted scores across all indicators, offering a comprehensive and quantitative assessment of the enterprise's economic resilience.

The first critical step is the standardization of the data. This step is necessary because the raw data of different indicators often have varying units and scales, which can introduce bias when aggregating them. To ensure comparability and eliminate the effects of differing units, we applied Min-Max normalization (MMS) across all the indicators. The Min-Max normalization formula is defined as:

$$X' = \frac{X - X_{\min}}{X_{\max} - X_{\min}}, \tag{2}$$

where X – the original value of the measurable item;

X_{max}, X_{min} – the minimum and maximum values for that measurable item.

Due to normalization all measured items are moved into scale [0; 1].

On the base of variable weights (Fig. 1) the weight of each measured item is calculated as result of dividing variable's weight on the quantity of items in variable (Table 1).

The results of calculation of each measured item's weight are represented at Table 3.

Table 3 – Measured Items' weight value

Variable (with weight) / measured item	Index weight
Financial Health (weight: 13.99%)	
Current Ratio	3.50%
Quick Ratio	3.50%
Debt-to-Asset Ratio	3.50%
Return on Equity (ROE)	3.50%
Market Performance (weight: 6.96%)	
Market Capitalization	2.32%
Stock Price Volatility	2.32%
Market Share	2.32%
Technological Innovation (weight: 3.55%)	
R&D Expenditure	1.18%
Number of Patents	1.18%
Technology Investment	1.18%
Management Efficiency (weight: 41.44%)	
Leadership Stability	20.72%
Organizational Structure & Decision-making Efficiency	20.72%
External Policy & Legal Environment (weight: 34.07%)	
Compliance	17.04%
Government Policy Changes	17.04%

On the basis of open sources of data Economic Security Index for Tencent Company was calculated for each month of 2022-2023 (Table 4) [7-9].

The ESI shows significant improvement, peaking at 0.734 in June 2022, indicating strong economic security driven by solid financial health, market position,

and technological investment. Early 2023 was a little decline: The ESI dropped to its lowest point of 0.507 in March 2023, likely due to external factors such as market volatility and policy shifts that temporarily impacted Tencent's stability. Recovery was presented in the second half of 2023: the index showed a strong recovery, reaching 0.745 by December 2023, reflecting improved market performance and better overall economic security.

Table 4 – Dynamics of Economic Security Index for Tencent Company

Date	Economic Security Index (ESI)
2022/1/1	0.284
2022/2/1	0.332
2022/3/1	0.426
2022/4/1	0.345
2022/5/1	0.52
2022/6/1	0.734
2022/7/1	0.471
2022/8/1	0.57
2022/9/1	0.586
2022/10/1	0.646
2022/11/1	0.612
2022/12/1	0.642
2023/1/1	0.681
2023/2/1	0.577
2023/3/1	0.507
2023/4/1	0.525
2023/5/1	0.531
2023/6/1	0.625
2023/7/1	0.59
2023/8/1	0.563
2023/9/1	0.623
2023/10/1	0.693
2023/11/1	0.705
2023/12/1	0.745

Tencent's ESI shows a positive trend overall, with notable fluctuations. The company's economic security improved significantly by 47% from March 2023 to December 2023, reflecting successful adaptation to challenges and a strengthening of

key areas. Although the average ESI of 0.564 is above the midpoint, there remains room for further improvement, particularly in managing external risks and market volatility.

The Pearson correlation analysis evaluates the relationships between the Economic Security Index (ESI) and various economic security indicators for Tencent. This statistical tool helps to identify and quantify the strength and direction of associations between key financial, market, technological, and organizational indicators (Table 5).

Based on the linear regression analysis of the Economic Security Index (ESI) and its associated economic security indicators for Tencent, we focus on the variables that have statistically significant relationships with ESI: Return on Equity (ROE), Market Capitalization (Billion USD), Market Share, Organizational Structure & Decision-making Efficiency, Compliance, Government Policy Changes.

The linear regression analysis reveals that Return on Equity (ROE) has a statistically significant positive relationship with the Economic Security Index (ESI), underscoring the importance of profitability in enhancing Tencent's economic security. The Market Capitalization, Market Share, Organizational Structure & Decision-making Efficiency, Compliance, and Government Policy Changes indicators show weak to moderate positive relationships with ESI, but these relationships are not statistically significant, suggesting they do not directly impact Tencent’s economic security in the given timeframe.

Return on Equity (ROE) shows a significant positive relationship with the Economic Security Index (ESI). This result suggests that higher profitability (as measured by ROE) is crucial in enhancing Tencent's economic security. It indicates that the ability to generate profit from shareholders' equity is a key driver of Tencent’s economic resilience.

Table 5 – Linear regression analysis results (n=24) for dependent variable Economic Security Index (ESI)

Indicator	Nonnormalized coefficient		Standardization coefficient	t	p	Collinearity diagnosis	
	B	Standard error	Beta			VIF	tolerance
constant	0.059	0.087	-	0.677	0.516	-	-
MMS_Current Ratio	0.249	0.150	0.571	1.652	0.133	21.858	0.046
MMS_Quick Ratio	-0.036	0.172	-0.074	-0.208	0.840	23.497	0.043
MMS_Debt to Asset Ratio	-0.027	0.074	-0.057	-0.369	0.721	4.307	0.232
MMS_Return on Equity (ROE)	0.216	0.066	0.397	3.244	0.010*	2.735	0.366
MMS_Market Capitalization (Billion USD)	-0.718	1.121	-1.787	-0.641	0.538	1421.804	0.001
MMS_Stock Price Volatility	0.056	0.070	0.123	0.791	0.449	4.451	0.225
MMS_Market Share	1.320	2.200	3.285	0.600	0.563	5477.180	0.000
MMS_R&D Expenditure (Billion USD)	-0.384	2.495	-0.957	-0.154	0.881	7055.903	0.000
MMS_Number of Patents	0.556	1.582	1.429	0.352	0.733	3018.767	0.000
MMS_Technology Investment (Billion USD)	-0.448	1.508	-1.134	-0.297	0.773	2664.133	0.000
MMS_Leadership Stability (Times)	0.050	0.032	0.178	1.534	0.159	2.466	0.406
MMS_Organizational Structure & Decision-making Efficiency (Score)	0.063	0.081	0.152	0.782	0.454	6.917	0.145
MMS_Compliance (Score)	0.010	0.084	0.021	0.116	0.910	5.776	0.173
MMS_Government Policy Changes (Score)	0.059	0.056	0.132	1.058	0.318	2.863	0.349
R 2	0.951						
Adjust R 2	0.874						
F	F (14,9)=12.411,p=0.000						
D-W	2.387						
* p<0.05 ** p<0.01							

Market Capitalization exhibits a negative relationship with ESI, but this relationship is not statistically significant (p>0.05). Although the magnitude of the coefficient suggests that market capitalization could influence economic security, the

relationship lacks statistical significance, meaning that it does not play a major role in determining ESI in this model.

Market Share shows a strong positive relationship with ESI, but this relationship is not statistically significant. Although a larger market share is generally associated with greater stability and economic security, it does not have a significant impact on the ESI in this specific analysis.

The correlation between Organizational Structure & Decision-making Efficiency and ESI is positive but statistically insignificant. This indicates that, although organizational structure and efficient decision-making may influence long-term business performance, they do not immediately contribute significantly to Tencent's economic security in the context of this regression model.

These findings indicate that profitability (ROE) is the primary driver of economic security for Tencent, while other factors, such as market share and organizational efficiency, while important, do not have a statistically significant impact on ESI in this specific model.

On the basis of existent data the Structural Equation Modeling (SEM) was provided (Fig. 2). Structural Equation Modeling (SEM) is a sophisticated statistical approach that enables researchers to explore and analyze the relationships between observed variables and underlying latent constructs. It effectively combines principles from factor analysis which identifies underlying factors from observed variables, and multiple regression analysis, which assesses how one set of variables predicts another.

Results of Structural Equation Modeling corresponds with results of Correlation analysis and Multiple Regression Analysis.

It can be seen from the regression analysis that factor 5 has the greatest influence on the economic security index (ESI), and the relationship is positive. Other factors (factor 1, factor 2, factor 3 and factor 4) also have different degrees of influence on ESI, among which the influence of factor 3 and factor 4 is negative, especially the negative

influence of factor 4 on ESI is stronger. On the whole, the five independent variables have significant influence on the economic security index ESI.

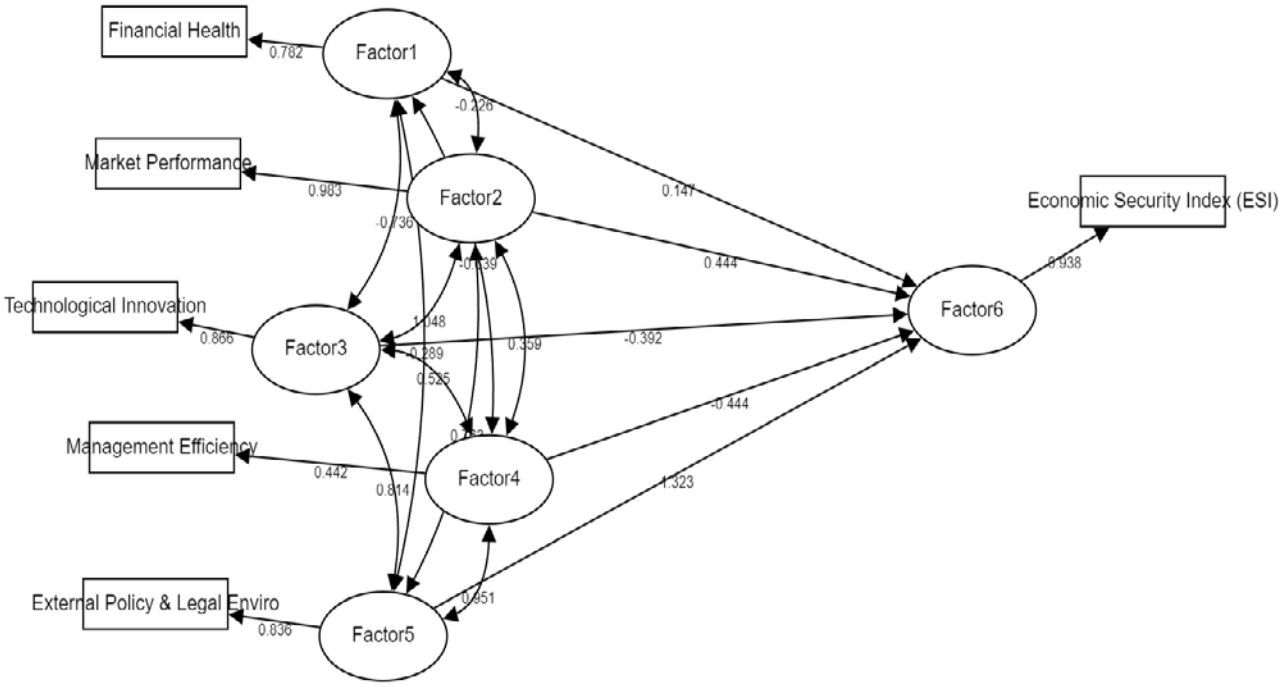

Figure 2 – Structural Equation Modeling Results

In conclusion, five hypotheses H1-H5, which focus on the relationship between the independent variables (Financial Health, Market Performance, Technological Innovation, Management Efficiency, and External Policy & Legal Environment) and the dependent variable (Economic Security Index, ESI), are evaluated in light of the regression results.

The 1st hypothesis (H1), which posited a positive relationship between Financial Health and ESI, was supported by the data. The significant positive regression coefficient (0.161) for Financial Health confirms that a company's financial stability contributes positively to its economic security. However, the influence of Financial Health was relatively modest, indicating that other factors, such as Market Performance and External Policy & Legal Environment, might have a more substantial impact on ESI.

The 2nd hypothesis (H2), suggesting that Market Performance would positively influence ESI, was also supported. The significant positive relationship (regression coefficient = 0.250) between Market Performance and ESI demonstrates that a strong market position – evidenced by factors like market capitalization and market share – plays a critical role in enhancing a company's economic security. This finding highlights the importance of maintaining a competitive edge in the market as a key component of economic resilience.

H3, proposing a negative relationship between Technological Innovation and ESI, was partially supported. While the negative regression coefficient (-0.168) suggests a counterintuitive result, it indicates that in this specific model, greater investment in technological innovation might not immediately correlate with a higher economic security index. Further analysis could be required to understand the nature of this negative relationship, possibly considering the long-term impacts of innovation on economic security.

The 4th hypothesis, which suggested that Management Efficiency negatively impacts ESI, was strongly supported. The significant negative coefficient (-0.430) for Management Efficiency implies that inefficiencies in organizational structure and decision-making reduce a company's ability to maintain high economic security. This suggests that effective management practices are vital for sustaining long-term stability.

Finally, the 5th hypothesis, which posited a strong positive relationship between External Policy & Legal Environment and ESI, was overwhelmingly supported. The exceptionally high positive coefficient (1.113) for External Policy & Legal Environment indicates that a favorable external environment-characterized by compliance, stable policies, and strong legal frameworks-directly contributes to a company’s economic security. This finding underscores the critical importance of navigating and adapting to external regulatory and political landscapes to ensure sustainable growth.

The hypothesis testing results provide strong evidence for the significant relationships between the five self-variables and ESI. While some relationships, such as those between Market Performance and ESI, were expected, others, like the negative

relationship between Technological Innovation and ESI, offer valuable insights that warrant further exploration. These findings emphasize the need for a holistic approach to enhancing corporate economic security, taking into account both internal capabilities and external influences.

The results confirmed that Market Performance and External Policy & Legal Environment have the most substantial positive impacts on ESI, highlighting the importance of a strong market presence and a favorable regulatory environment in ensuring a company's economic stability. On the other hand, Management Efficiency was found to have a significant negative impact on economic security, suggesting that poor management practices can severely undermine a company's ability to mitigate risks and adapt to changes. Financial Health also showed a positive, albeit moderate, influence on ESI, indicating that financial stability remains a critical factor but is not as dominant as market and policy factors. The negative relationship between Technological Innovation and ESI, though surprising, points to the complexity of how innovation can impact a company's economic security in the short term.

Overall, this research underscores the multifaceted nature of economic security, where internal factors such as financial stability and management practices, combined with external factors like market dynamics and regulatory environments, collectively shape a company's ability to weather economic challenges. The findings suggest that companies aiming to enhance their economic security should adopt a balanced approach, focusing not only on improving internal operations but also on adapting to and influencing external factors.

The results of this study highlight the critical role that Market Performance plays in determining economic security. Companies should prioritize strategies that bolster their market position, such as improving product offerings, increasing market share, and enhancing customer satisfaction. Strategic investments in marketing, customer retention, and global market expansion are essential for strengthening market performance and, consequently, the company's economic security.

External Policy & Legal Environment was found to have the strongest positive impact on the ESI, indicating that favorable external conditions play a significant role in ensuring economic security. Companies should invest in compliance management systems to ensure they meet local, national, and international legal requirements. Additionally, engaging proactively with policymakers and participating in industry regulatory discussions can help firms shape favorable legal and regulatory environments, thereby enhancing their resilience to external shocks and uncertainties.

The study reveals a negative correlation between Management Efficiency and the Economic Security Index (ESI), indicating that ineffective management practices undermine economic security. To address this, companies should focus on enhancing their organizational structure, decision-making processes, and leadership skills. This can be accomplished through leadership training programs, more efficient decision-making frameworks, and improved interdepartmental communication. Strengthening management efficiency enables companies to tackle challenges more effectively and enhance overall performance.

Although technological innovation plays a crucial role in a company's growth, this study highlights a negative correlation between innovation and economic security, indicating that excessive or poorly managed innovation efforts can deplete resources in the short term. Companies should focus on balancing innovation with economic stability by strategically planning and aligning R&D investments with long-term security objectives. This approach ensures that technological advancements support the company’s overall resilience and sustainable growth.

In summary, businesses should implement a comprehensive strategy to bolster economic security by addressing internal strengths and external market and policy factors. Enhancing market performance, financial stability, management efficiency, technological innovation, and responsiveness to external conditions are key to improving the Economic Security Index (ESI) and achieving sustainable stability. The strategic insights from this study provide a roadmap for companies to establish a stronger and more resilient foundation for long-term growth.

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