https://doi.org/10.22353/jbai.2026120104

FINANCIAL ADAPTABILITY AND COMPANY PERFORMANCE OF MINING SECTOR JOINT-STOCK COMPANIES

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Abstract: This study examines the relationship between financial adaptability and firm profitability using a panel dataset of 90 firm-year observations from nine coal mining companies listed on the Mongolian Stock Exchange over the period 2015–2024. Financial adaptability is measured by a composite index (FAI) constructed with equal weights from four indicators: current ratio, asset turnover, proportion of short-term assets, and gross profit margin. This study represents an initial attempt to construct a composite measure of financial adaptability for coal mining firms and provides empirical support for dynamic capability theory in the Mongolian context.
Keywords: financial adaptability; firm performance; coal mining; composite index; macroeconomic shocks; panel regression

УУЛ УУРХАЙН САЛБАРЫН ХУВЬЦААТ КОМПАНИУДЫН САНХҮҮГИЙН ДАСАН ЗОХИЦОХ ЧАДВАР БА КОМПАНИЙН ГҮЙЦЭТГЭЛ

Хураангуй: Энэхүү судалгаа нь Монголын хөрөнгийн биржид бүртгэлтэй нүүрс олборлох 9 компанийн 2015-2024 оны 90 компани-жилийн панел өгөгдлийг ашиглан санхүүгийн дасан зохицох чадвар болон компанийн ашигт ажиллагааны хоорондын хамаарлыг судалсан. Санхүүгийн дасан зохицох чадварыг эргэлтийн харьцаа, хөрөнгийн эргэлт, богино хугацааны хөрөнгийн хувь, нийт ашгийн маржин зэрэг дөрвөн үзүүлэлтийн жигд жинт нийлмэл индекс (FAI)-ээр хэмжсэн. Судалгаа нь нүүрс олборлох компаниудад зориулсан санхүүгийн дасан зохицох чадварын нийлмэл хэмжилтийн анхны оролдлогыг агуулж, Монголын контекстэд динамик чадварын онолыг эмпирикийн байдлаар баталгаажуулж байна.
Түлхүүр үгс: санхүүгийн дасан зохицох чадвар; компанийн гүйцэтгэл; нүүрс олборлох; нийлмэл индекс; макро эдийн засгийн цочрол; панел регресс

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1. INTRODUCTION

The coal mining sector is a cornerstone of the Mongolian economy. As of 2024, coal exports reached 83.7 million tons, and according to 2025 performance data, it accounted for 11.54% of the consolidated state budget revenue (Ministry of Mining and Heavy Industry, 2026). However, the average export price of coal has fluctuated significantly, plummeting from a peak of $207.3/ton in 2022 to $64.1/ton in 2025, placing substantial financial pressure on firms within the sector. In such a volatile external environment, there is a critical need to explain why certain companies maintain relatively stable profitability while others experience sharp declines.

Compared to firms in other industries, mining companies particularly coal producers are exposed to multiple, overlapping external shocks. These include fluctuations in international coal prices, shifts in Chinese demand, logistical barriers at border crossings, cost pressures driven by rising oil prices, and changes in domestic monetary policy. For instance, in 2020, the COVID-19 pandemic led to the closure of Mongolia-China border crossings; consequently, the coal export price dropped from $79.1/ton (2015) to $55.6/ton, and export volumes fell sharply from 33.5 million tons (2019) to 27.0 million tons. These factors severely impacted the profitability of coal mining companies listed on the Mongolian Stock Exchange (MSE).

Regarding the domestic financial system, the Mongolian corporate sector possesses a financing structure heavily dependent on high bank interest rates (12–13% in 2022–2023), coupled with an underdeveloped long-term capital market. In this context, a firm's internal financial equilibrium specifically liquidity, asset utilization, and the quality of debt management serves as the primary determinant for navigating external shocks. Therefore, systematically measuring financial adaptability and linking it to corporate performance holds significant theoretical and practical importance.

The primary objective of this study is to empirically determine the relationship between the financial adaptability of MSE-listed coal mining companies and their profitability, and to analyze how this relationship evolves during macroeconomic shocks. This research offers the following innovative contributions:

1. Development of a Financial Adaptability Index (FAI) for the Coal Sector: This index integrates four financial metrics current ratio, asset turnover, the proportion of short-term assets (CATA), and gross profit margin to provide a multidimensional representation of adaptability.
2. Utilization of Coal Export Price as a Shock Variable: Using coal export price series ($/ton, 2015–2024) as a shock variable provides a novel contribution to the study of Mongolian mining firms. While previous studies have often utilized

GDP growth or interest rates, directly measuring coal price shocks is more aligned with the specific nature of the industry.

3. Comprehensive Dataset: The study utilizes a panel dataset of 90 firm-year observations from nine coal mining companies listed on the MSE from 2015 to 2024. This represents one of the first comprehensive studies to fully cover the coal mining firms in Mongolia in an integrated manner.

Accordingly, this study poses the following research questions and hypotheses, each grounded in dynamic capability theory (Teece et al., 1997) and the academic literature on financial flexibility (Gamba & Triantis, 2008; Denis, 2011):

- **RQ1**: Is financial adaptability (FAI) positively and statistically significantly associated with the profitability (ROA) of coal mining firms?

  H1: Financial adaptability has a positive and stable relationship with the profitability of coal mining companies. This hypothesis is based on the logic that highly adaptable firms protect their profitability by maintaining stable liquidity and asset utilization.

- **RQ2**: Does FAI serve as a conditional buffer that mitigates the decline in corporate profitability during coal price shocks and interest rate pressures?

  H2: During shocks such as falling coal prices or rising interest rates, firms with high adaptability will experience a smaller decline in profitability. Following the logic of financial buffers (Tognazzo et al., 2016; Fahlenbrach et al., 2021), internal resource capabilities mitigate the impact of external shocks.

- **RQ3**: Does the impact of FAI differ between high and low coal export price conditions?

  H3: The impact of FAI is relatively stronger during high coal price periods compared to low price periods. This is a conditional hypothesis suggesting that firms utilize their adaptability for business expansion during high-price periods, while focusing on cost control and preservation during low-price periods.

2. LITERATURE REVIEW

2.1. Theoretical Foundations of Financial Flexibility and Adaptability

The literature on financial flexibility demonstrates that internal financial resources play a crucial role in mitigating external shocks. Gamba and Triantis (2008) argued that flexibility

protects investment opportunities and increases firm value, while Denis (2011) linked it to corporate liquidity, emphasizing the importance of convertible resources during financial distress. Furthermore, Bates et al. (2009) demonstrated that firms increase cash reserves as uncertainty rises; Marchica and Mura (2010) found that debt capacity protects investments; Ferrando et al. (2016) showed that financial flexibility supports investment even under tight credit conditions; and Fahlenbrach et al. (2021) evidenced that flexible firms experienced smaller declines in profitability during COVID-19. In the Mongolian coal sector, where bank-dependent financing structures dominate, internal liquid reserves serve as the primary factor for resilience.

However, a limitation of these studies is their reliance on a few proxy indicators (e.g., cash reserves, current ratio, debt capacity), which fail to capture a firm's multidimensional regulatory capabilities (Bancel & Mittoo, 2011). Consequently, research is shifting toward the broader concept of financial adaptability, which represents how resources are dynamically mobilized in response to environmental changes rather than just the volume of resources held (Endres, 2018; Reeves & Deimler, 2012). For coal mining firms, a high current ratio alone does not represent adaptability; rather, it is the ability to rapidly mobilize liquid reserves and adjust strategies and cost structures when coal prices plummet or borders close that defines true adaptability.

2.2. Dynamic Capabilities, Resilience, and Financial Adaptation

Dynamic capability theory is the core theoretical foundation of this study, emphasizing that firms must be able to integrate, build, and reconfigure internal and external resources in volatile environments (Teece et al., 1997). In this context, financial adaptability can be viewed as the financial expression of dynamic capabilities. Eisenhardt and Martin (2000) defined dynamic capabilities as the process of integrating and reallocating resources in response to market changes, which directly relates to the flexible management of financial structures.

Volberda (1999) identified flexibility as a key condition for competitiveness, dividing it into structural and strategic dimensions, where financial flexibility is a vital structural component. Teece (2007) categorized dynamic capabilities into three stages: sensing, seizing, and reconfiguring, which defines the logical process of financial adaptability. Specifically, the ability to recognize coal price shifts in real-time, direct resources strategically, and appropriately adjust financial structures are practical manifestations of adaptability. This is further deepened by the literature on organizational resilience. Duchek (2020) linked resilience to three stages—anticipation, coping, and adaptation—where financial resources serve as the basis for both preparation and recovery. McManus et al. (2008) also viewed resilience as an integrated system of readiness, response, and recovery, highlighting the need for a multidimensional approach. Barasa et al. (2018) defined resilience as a developable dynamic capability, theoretically explaining the variable nature of the FAI. Finally, McKee

et al. (1989) first proved the link between strategic adaptability and performance, while Oktemgil and Greenley (1997) confirmed that highly adaptive firms achieve superior performance. Thus, adaptability is a primary factor in building sustainable firm value, especially in uncertain and volatile environments.

2.3. Macroeconomic Shocks in Coal Mining Companies

Studies prove that commodity price shocks strongly affect companies in resource-dependent economies. Kilian (2009) developed a theoretical model of how price shocks influence business operations through supply and demand channels, while Hamilton (2011) confirmed that these shocks significantly impact economic cycles. Frankel (2014) explained that commodity price changes affect export-dependent countries through multiple channels, including exchange rates, income flows, financing conditions, and investment.

In a coal-dependent country like Mongolia, mining firms are exposed to the combined effects of exchange rates, policy rates, and market trends. Additionally, Mongolian-Chinese border crossings act as a sector-specific external shock. For instance, the 2020 COVID-19 border closure caused exports to drop from 33.5 to 27.0 million tons, representing a "logistics shock" distinct from price shocks. Therefore, research on coal mining firms must consider both price changes and border-related factors.

The COVID-19 pandemic accelerated research into corporate financial resilience. Ding et al. (2021) showed that firms with flexible financial structures had more stable performance, and Zheng (2022) proved that cash reserves acted as a buffer. Fahlenbrach et al. (2021) confirmed that firms with high financial flexibility experienced smaller declines in profitability, a finding applicable to the Mongolian context. Specifically, during the 2020—2021 border closures, firms with strong liquid reserves were able to maintain operations without additional financing.

While studies in Mongolia (B. Batchimeg, 2017; L. Enkh-Amgalan et al., 2018) have examined capital structure and macroeconomic factors, research specifically targeting the coal sector or isolating coal price shocks remains limited. Thus, the need to study the interaction between the financial adaptability of coal mining firms and macroeconomic shocks persists.

2.4. Methodology for Composite Index Measurement

As financial adaptability is a multidimensional theoretical concept that is not directly observable, studies confirm that using a single proxy is insufficient. Sheng and Li (2025) attempted to measure corporate resilience through dynamic factor analysis, confirming that resilience is a multidimensional, dynamic, and latent structure. Ciasullo et al. (2023) also found that a single metric is inadequate for studying the alignment between organizational resilience and sustainability.

There are two primary methods for constructing multidimensional composite indices: Principal Component Analysis (PCA) and equal-weight aggregation. PCA determines weights based on the variance of the data, freeing it from subjective weighting assumptions (Sheng & Li, 2025). However, PCA can be distorted by variables with high variance. In this study, an equal-weighted FAI was used as the primary model, while PCA was utilized for robustness checks—a justified methodological choice.

Bancel and Mittoo (2011) identified the limitations of measuring financial flexibility with a single indicator, emphasizing that a multidimensional approach is more meaningful. Yousefi and Yung (2021) similarly acknowledged that using a single proxy constitutes a methodological limitation. The practical conclusion from these studies is that a composite index is theoretically and empirically superior to a single proxy, provided that its robustness is verified.

2.5. Research Gap

Existing literature reveals four critical research gaps. First, no study in Mongolia has developed a multidimensional composite index for financial adaptability specific to the coal sector; previous works have relied on one or two proxies like cash reserves or current ratios. Second, research linking average coal export prices as a shock variable to firm profitability is scarce in Mongolia. Third, there is a lack of long-term (10-year) panel data studies encompassing all coal mining firms listed on the MSE. Fourth, there is limited research treating financial adaptability not just as a direct determinant of profitability, but as a conditional factor interacting with coal price shocks. To address these gaps, this study constructs a Financial Adaptability Index (FAI) based on panel data from 9 listed coal mining firms (2015–2024) and analyzes its interaction with coal price shocks. Within this framework, adaptability is viewed not as a constant determinant of profitability, but as a conditional capability that manifests differently during high and low coal price cycles.

3. RESEARCH METHODOLOGY

The methodology of this study aims to systematically assess how a firm's financial adaptability influences performance under macroeconomic shocks. To achieve this, a panel data-based econometric approach is employed, integrating firm-level financial metrics with macroeconomic variables. The study's distinctive feature is treating adaptability not only as a direct influence but as a dynamic factor serving as a conditional buffer during macro shocks.

The study utilizes panel data from the financial statements of 9 coal mining companies listed on the MSE over the period 2015–2024, forming a total of 90 firm-year observations. The data were collected and aggregated from open MSE sources. For firms with missing 2024 data, linear extrapolation based on 2021–2023 trends was applied to create a

balanced panel and improve the reliability of the estimation. The sampled companies are representative of Mongolia's coal sector exports and domestic supply, allowing for a realistic reflection of macroeconomic shocks.

To measure firm performance, Return on Assets (ROA) was utilized, as it expresses profitability relative to firm size. ROA was defined as follows:

$$ROA_{it} = \frac{Net\ income_{it}}{Total\ assets_{it}}$$

To mitigate the impact of outliers, ROA was winsorized at the 1st and 99th percentiles. Preliminary analysis results indicate that the profitability of the firms exhibits substantial volatility, highlighting the necessity of simultaneously examining the influence of macroeconomic environmental shifts and internal financial factors.

Since financial adaptability is not directly observable, it was defined as a multidimensional composite index. For this purpose, four indicators were utilized: short-term liquidity (current ratio), asset utilization efficiency (asset turnover), internal financial buffer (proportion of short-term assets), and operational profitability (gross profit margin). Together, these metrics represent a firm's capacity to mobilize and reallocate resources and to adjust its cost structure. Each variable was standardized within its respective year to ensure comparability and transformed as follows:

$$Z_{kit} = \frac{X_{kit} - \overline{X_{kt}}}{\sigma_{kt}}$$

Subsequently, the Financial Adaptability Index (FAI) was constructed using the equal-weighted average of the standardized values:

$$FAI_{it} = \frac{1}{4}\sum_{k=1}^{4} Z_{kit}$$

The use of equal weights mitigates the risk of the index being distorted by the extreme volatility of any single variable. Additionally, to ensure that the results are independent of the weighting methodology, a version of the index based on Principal Component Analysis (PCA) was utilized for the robustness analysis:

$$FAI_{it}^{PCA} = \sum_{k=1}^{4} w_k\, Z_{kit}$$

To measure macroeconomic shocks, the annual change in the average export price of Mongolian coal was utilized as a sector-specific shock variable. This directly reflects shifts in global market supply and demand and is defined as follows:

$$CoalShock_t = \frac{CoalPrice_t - CoalPrice_{t-1}}{CoalPrice_{t-1}} * 100$$

Furthermore, to capture the aggregate impact of the economic environment, macro-variables such as GDP growth, the policy interest rate, inflation, and stock market capitalization were incorporated into the model. These variables represent common environmental factors that affect all firms uniformly.

To control for firm-level heterogeneity, firm size and financial leverage were utilized as control variables. Firm size was defined as the natural logarithm of total assets, while leverage was determined by the ratio of total liabilities to total assets:

$$Size_{it} = \ln(Total\ assets_{it}), Lev_{it} = \frac{Total\ debt_{it}}{Total\ assets_{it}}$$

In terms of econometrics, several panel regression models were employed. The baseline model evaluates the direct impact of financial adaptability as follows:

$$ROA_{it} = \beta_0 + \beta_1 FAI_{it} + \beta_2 Size_{it} + \beta_3 Lev_{it} + \varepsilon_{it}$$

Since the primary interest of this study is to determine whether financial adaptability functions as a buffer during macroeconomic shocks, the interaction model is specified as follows:

$$ROA_{it} = \beta_0 + \beta_1 FAI_{it} + \beta_2 Shock_t + \beta_3 (FAI_{it} * Shock_t) + \beta_4 Size_{it} + \beta_5 Lev_{it} + \varepsilon_{it}$$

In this model, the coefficient $\beta_3$is the key parameter indicating whether adaptability mitigates the impact of macroeconomic shocks. To further identify the transmission mechanism of financial adaptability, the transmission channel of short-term liquidity (CATA) was examined using a two-stage regression approach. Additionally, a threshold analysis was conducted by partitioning the sample based on coal price levels to evaluate whether the impact of adaptability varies depending on market conditions.

To ensure the reliability of the results, several robustness checks were employed, including fixed-effects models, lagged FAI, and PCA-based indices. However, this study is subject to certain limitations, such as being restricted to MSE-listed companies, the potential

exclusion of unobserved factors, and a relatively small sample size. Finally, the definitions, measurements, and expected signs of all variables used in the study are summarized as follows:

Table 1. Unified Definition, Measurement, and Expected Signs of Variables

Variable	Label	Description	Expectation	Source
ROA (related)	ROA_{it}	Net income / Total assets	-	MSE financial report
FAI (weighted average)	FAI_{it}	Average of four z-scores	+	Researcher's calculation
FAI (PCA)	FAI_PCA_{it}	Weighted by PC1 loading	+	Researcher's calculation
Turnover ratio	CR_{it}	Current assets / Short-term debt	+	MSE financial report
Asset turnover	AT_{it}	Sales / Total assets	+	MSE financial report
CATA	$CATA_{it}$	Current assets / Total assets	+	MSE financial report
Gross profit margin	GPM_{it}	Gross profit / Sales	+	MSE financial report
Company size	$SIZE_{it}$	ln(Total assets)	+/-	MSE financial report
Leverage	LEV_{it}	Total debt / Total assets	-	MSE financial report
GDP growth	$GDPG_t$	Annual real GDP growth %	+	World Bank
Interest rate	INT_t	Central Bank policy rate %	-	Bank of Mongolia
Inflation	$INFL_t$	Annual CPI growth %	-	IMF
SMC/GDP	SMC_t	MSE capitalization / GDP %	+/-	MSE, NSO

Coal price	$COAL_t$	Export average price, $/ton	+/-	Customs, Ministry of Finance

ROA, LEV have been winsorized at the 1%-99% levels. Each component variable of FAI has been standardized within the year using the z-score. The expected signs are based on theoretical assumptions.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics and Correlation Analysis

Table 2 presents the descriptive statistics for the variables used in the study. The mean ROA of coal mining companies is 0.12 (12%), with a significant standard deviation of 0.18, indicating high volatility in profitability across the sector. The Financial Adaptability Index (FAI) ranges from a minimum of -0.84 to a maximum of 2.11, reflecting substantial differences in internal financial capabilities among the firms. The average coal export price (Price) over the sample period was $89.9/ton, which fluctuated between $55.6/ton and $207.3/ton, confirming the presence of significant external price shocks.

Table 2. Descriptive Statistics (N = 90 firm-years, 9 companies, 2015-2024)

Variables	Mean	Median	Std	Min	Max
ROA	0.036	0.011	0.186	-0.510	0.547
FAI (equal weight)	-0.093	-0.146	0.534	-0.987	1.058
FAI (PCA)	0.000	0.348	1.259	-3.007	2.419
Current ratio	1.535	0.853	1.548	0.051	5.000
Financial leverage	0.895	0.644	1.025	0.026	4.748
Asset Turnover	0.699	0.676	0.440	0.065	1.954
CATA	0.405	0.355	0.288	0.011	0.965
Gross profit margin	0.205	0.169	0.193	-0.186	0.675
Firm size (ln)	17.169	17.215	1.670	13.579	20.574

Source: Financial statements of the Mongolian Stock Exchange (MSE); researcher's calculations.

Table 3 presents the firm-specific FAI and ROA results. Tavantolgoi JSC exhibits the highest financial adaptability index (FAI = 0.765) and the highest profitability (ROA = 0.345). Conversely, Berkh-Uul JSC demonstrates the most significant negative profitability with an ROA of -0.194.

For Aduunchuluun JSC, Bayanteeg JSC, and Berkh-Uul JSC, the 2024 data points were estimated and imputed using the trend-based extrapolation method to maintain a balanced panel dataset.

Table 3. Average FAI and ROA by Company (2015–2024 averages, N = 90)

Компани	FAI mean	FAI median	FAI std	ROA mean	N
Tavantolgoi JSC	0.765	0.820	0.356	0.345	10
Baganuur JSC	0.445	0.429	0.072	-0.018	10
Taliin Gal JSC	0.174	0.148	0.367	0.031	10
Shariin Gol JSC	-0.127	-0.119	0.144	-0.012	10
Shivee-Ovoo JSC	-0.322	-0.305	0.219	-0.054	10
Mogoin-Gol JSC	-0.696	-0.685	0.039	0.084	10
Aduunchuluun JSC	-0.288	-0.270	0.204	-0.055	10
Berkh-Uul JSC	0.078	0.067	0.098	-0.194	10
Bayanteeg-JSC	-0.867	-0.859	0.046	0.196	10

Source: Researcher's calculation. FAI denotes an equally-weighted composite index. Data for 2024 (labeled as 'trend') are estimated via trend extrapolation.

The average export price of coal peaked at $207.3 per ton in 2022, coinciding with the height of the global energy crisis. In contrast, the price declined significantly to $55.6 per ton in 2020 due to the impact of the COVID-19 pandemic and associated border closures. This trend is illustrated in Figure 1.

Table 4. Key Macroeconomic Indicators (2015–2024)

Year	Coal Price $/ton	Coal Δ%	GDP Growth %	Inflation %	Interest Rate %	SMC/GDP %

2015	79.1	Base	2.5	1.0	13	5.45
2016	55.0	-30.5%	1.5	1.3	15	6.16
2017	81.3	+47.8%	5.6	6.3	12	8.73
2018	100.6	+23.7%	7.6	8.2	11	7.80
2019	93.1	-7.5%	5.5	5.2	11	7.22
2020	55.6	-40.3%	-4.4	2.3	6	8.19
2021	86.7	+55.9%	1.6	13.5	7	13.73
2022	207.3	+139.1%	5.0	14.2	13	12.79
2023	131.4	-36.6%	7.2	10.3	12	15.94
2024	102.7	-21.8%	5.0	6.8	10	16.21

Source: Ministry of Energy (MoE), General Administration of Customs (GAC), MONTSAME News Agency, APBI-ICMA, Bank of Mongolia, and the World Bank.

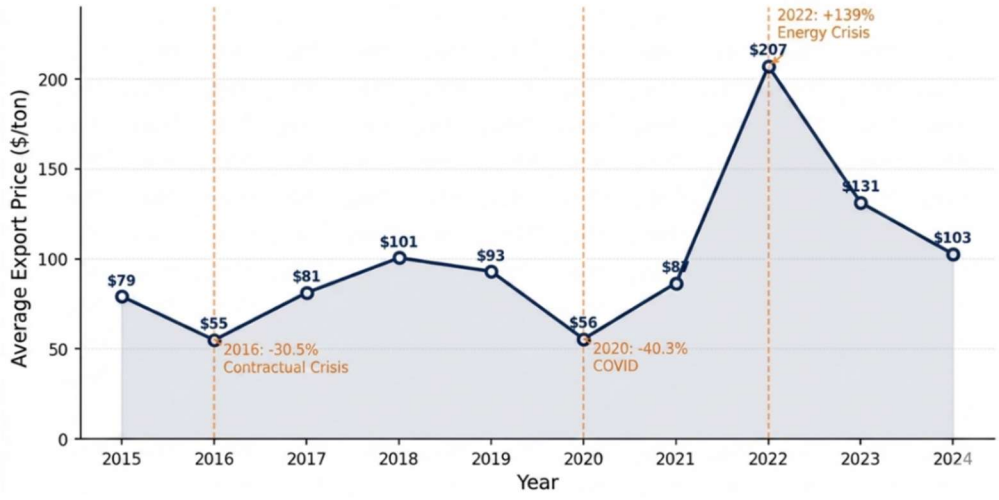

Figure 1. Average Export Price of Mongolian Coal (2015–2024, USD/ton)
Sources: General Administration of Customs, Ministry of Energy, MONTSAME, The Coal Trader, APBI-ICMA; Researcher's calculations.

4.2 Construction of the FAI and Baseline Regression

The Financial Adaptability Index (FAI) was constructed using an equally-weighted method. This approach was selected because the extreme current ratio values of Berkh-Uul JSC (CR ranging from 17 to 121) caused significant distortions in the Principal Component Analysis (PCA). Consequently, the equally-weighted FAI serves as the primary model, while the PCA-based index is utilized for robustness checks.

The first principal component (PC1) of the PCA accounts for 58.3% of the total variance (see Table 5). Furthermore, Variance Inflation Factor (VIF) diagnostics (Table 6) confirm that all values are below the threshold of 10, indicating that multicollinearity is not a concern in this model.

Table 5. PCA Loadings and Explained Variance

Component	PC1	PC2	PC3	PC4
Current ratio	0.680	0.421	0.589	0.103
Asset Turnover	-0.533	0.302	0.617	-0.490
CATA	-0.502	0.379	-0.522	-0.563
Gross profit margin	-0.038	0.762	-0.111	0.639
Variance Explained	0.583	0.275	0.086	0.056
Cumulative Variance	0.583	0.858	0.944	1.000

Note: PCA was performed after capping the Current Ratio (CR) at 5. PC1 accounts for 58.3% of the total variance.Source: Researcher's calculations.

Table 6. VIF Diagnostics and Multicollinearity Test

Variables	VIF
FAI (ew)	1.038
Firm size	1.164
Financial Leverage	1.181
GDP Growth Rate	2.310

Inflation Rate	5.695
Interest Rate	2.949
SMC/GDP	2.503
Coal Export Price (USD/ton)	3.862

Note: VIF > 10$ is commonly used as a threshold for identifying significant multicollinearity. All variables in this model remain within the acceptable limit, confirming the absence of multicollinearity issues

Table 7 presents the results of the baseline regression analysis. Across all three models, the coefficient for FAI is positive and statistically significant: OLS (β = 0.319***), OLS with controls (β = 0.289***), FE (β = 0.207**). RI = 0.648 indicates that the model possesses a high explanatory power. Regarding the control variables, firm size shows a significant positive correlation (β = 0.031***), while financial leverage exhibits a significant negative relationship (β = -0.068**) with the dependent variable. Figure 2 illustrates the individual firm-level FAI and ROA, and Figure 3 displays the temporal trends of ROA.

Table 7. Baseline Regression Results (Dependent Variable: ROA)

Variable	(1) OLS	(2) OLS + Control	(3) Firm FE
FAI (ew)	0.3189*** (6.25)	0.2890*** (8.86)	0.2074** (2.64)
Firm size		0.0305*** (3.47)	0.0595* (1.88)
Financial leverage		-0.0684** (-2.38)	-0.0033 (-0.03)
Constant	0.0218 (1.08)	-0.4258** (-2.45)	FE included
RI	0.418	0.648	0.155
Adjusted RI	0.408	0.630	0.125
Firm FE	No	No	Yes (9)

*Note: Heteroskedasticity-robust standard errors (HC3) are reported in parentheses. t-statistics are shown in brackets. Statistical significance is indicated by *p<0.10, **p<0.05, ***p<0.01. N=60. Sources: Mongolian Stock Exchange (MSE); Researcher's calculations.*

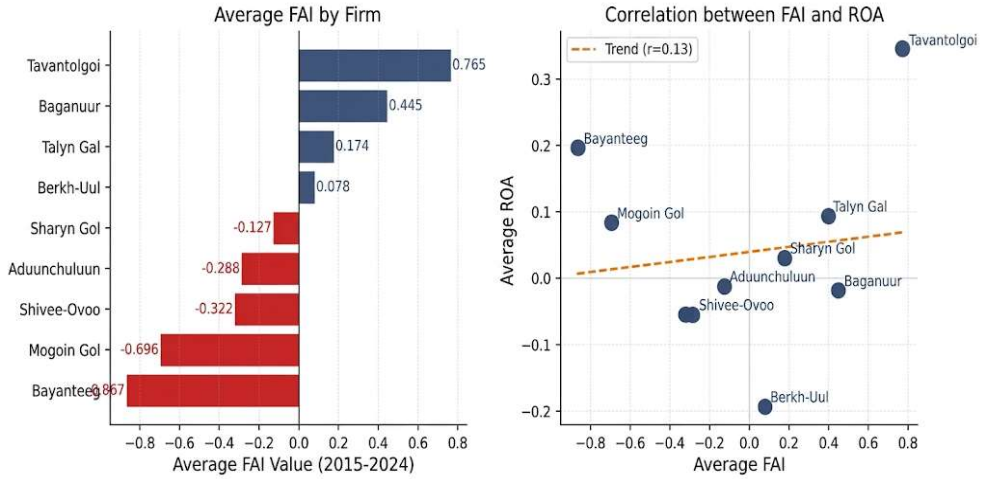

Figure 2. FAI and ROA by Firm (Left: Average FAI; Right: FAI ↔ ROA Scatter Plot) Sources: MSE Financial Reports (2015–2024); Source:Researcher's calculations.

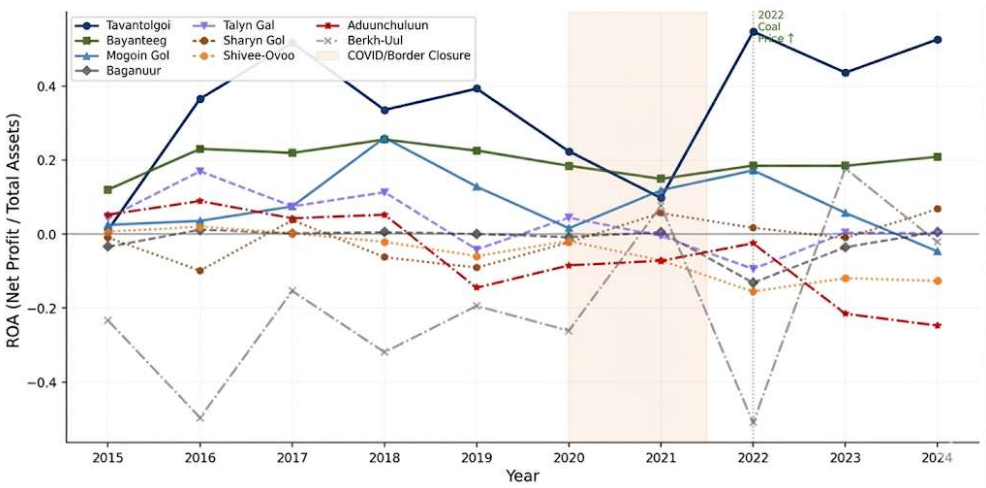

Figure 3. Temporal Trends of ROA (9 Companies, 2015–2024) Note: Shaded area represents the COVID-19 pandemic and border closure period (2020–2021).Sources: MSE; Researcher's calculations.

4.3 Interaction Analysis of Macroeconomic Shocks

Table 8 presents the results of the interaction effects between the FAI and five macroeconomic variables. The direct coefficient for FAI remains robust and statistically significant across models involving GDP growth ($\beta = 0.226^{***}$), inflation ($\beta = 0.240^{***}$), and coal prices ($\beta = 0.205^{**}$),However, the interaction terms FAIЧMacro Shock do not

reach the 10% significance threshold. This lack of statistical significance is likely attributable to the limited statistical ρower associated with the small sample size N = 60.

Table 8. Interaction Effects of Macroeconomic Shocks and FAI (Dependent Variable: ROA)

Variable	GDP growth	Interest rate	Inflation	SMC/GDP	Coal prices
FAI	0.2255*** (4.46)	0.1780 (1.19)	0.2399*** (4.00)	0.1451 (1.50)	0.2046** (2.11)
Macro Shock	0.0042 (0.91)	-0.0002 (-0.04)	0.0011 (0.29)	0.0048 (0.96)	-0.0001 (-0.17)
FAIЧMacro Shock	0.0160 (1.64)	0.0099 (0.76)	0.0072 (0.91)	0.0145 (1.57)	0.0008 (0.84)
Firm Size	0.0286*** (3.24)	0.0299*** (3.38)	0.0300*** (3.45)	0.0310*** (3.53)	0.0290*** (3.30)
Leverage	-0.0665** (-2.31)	-0.0655** (-2.21)	-0.0667** (-2.34)	-0.0700** (-2.44)	-0.0665** (-2.32)
RI	0.665	0.651	0.653	0.669	0.654

*Notes:(OLS) estimation with HC3 robust standard errors. t-statistics are reported in ρarentheses. Statistical significance levels:*ρ<0.10, **ρ<0.05, ***ρ<0.01. macroeconomic variable was included in a separate regression model. Sources: MSE, GAC, Bank of Mongolia, World Bank; Researcher's calculations.*

4.4 Mechanism Analysis and Coal Price Thresholds

A two-steρ mechanism analysis confirms that the FAI has a strong and ρositive correlation with (CATA) (β = 0.422***, t = 8.14) болохыг нотоллоо. However, after incorρorating CATA into the regression model, the variable itself does not exert a statistically significant imρact on (β = 0.213, ρ > 0.10) This suggests that CATA does not function as a direct mediating variable in the transmission mechanism.

Table 9. Mechanism Analysis: The CATA Channel

Variable	Step 1: CATA	Step 2: ROA
FAI	0.4219*** (8.14)	0.1992*** (2.93)
CATA (mediator)		0.2129 (1.61)
Firm Size	-0.0027 (-0.17)	0.0311*** (3.49)
Financial Leverage	-0.1176*** (-3.95)	-0.0433 (-1.06)
Constant	0.5615* (2.00)	-0.5713*** (-3.39)
RI	0.634	0.679

*Note: OLS HC3 SE. *p<0.10, **p<0.05, ***p<0.01. N=60.*

Threshold analysis, using the median coal export price ($89.9/ton) as the cutoff, reveals that the impact of the FAI is 41% higher during periods of high prices (N=30) (β = 0.331***) compared to periods of low prices (β = 0.235***), as shown in Table 11. This relationship is further illustrated in Figure 4.

Table 10. Coal Price Threshold Analysis (Median = $89.9/ton)

Variable	Price ≤ $89.9/тн	Price > $89.9/тн
FAI	0.2352*** (3.94)	0.3308*** (6.99)
Firm Size	0.0259* (1.84)	0.0337** (2.38)
Financial Leverage	-0.0434 (-1.15)	-0.0956** (-2.59)
Constant	-0.4474* (-1.83)	-0.6128*** (-2.84)
RI	0.715	0.669

*Note: OLS HC3 SE. *p<0.10, **p<0.05, ***p<0.01. Sources Researcher's calculations.*

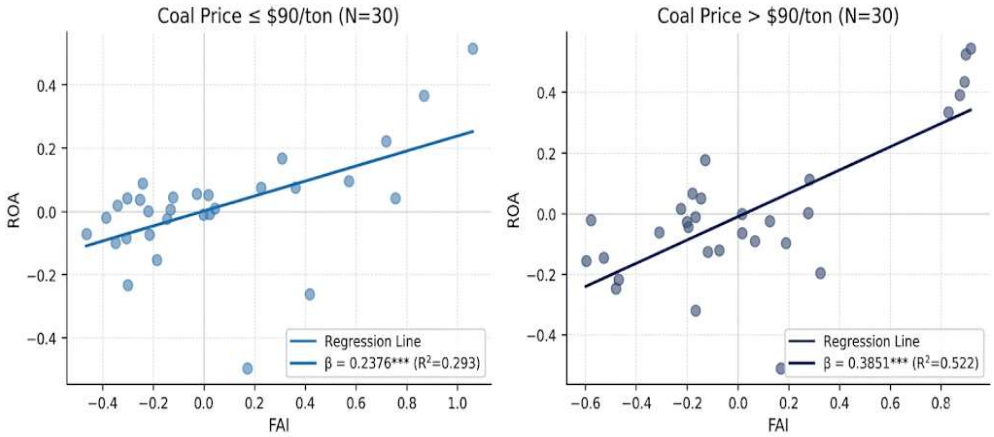

Figure 4. Correlation between FAI and ROA by Coal Price Threshold (Median = $89.9/ton) Sources: MSE, GAC; Researcher's calculations.

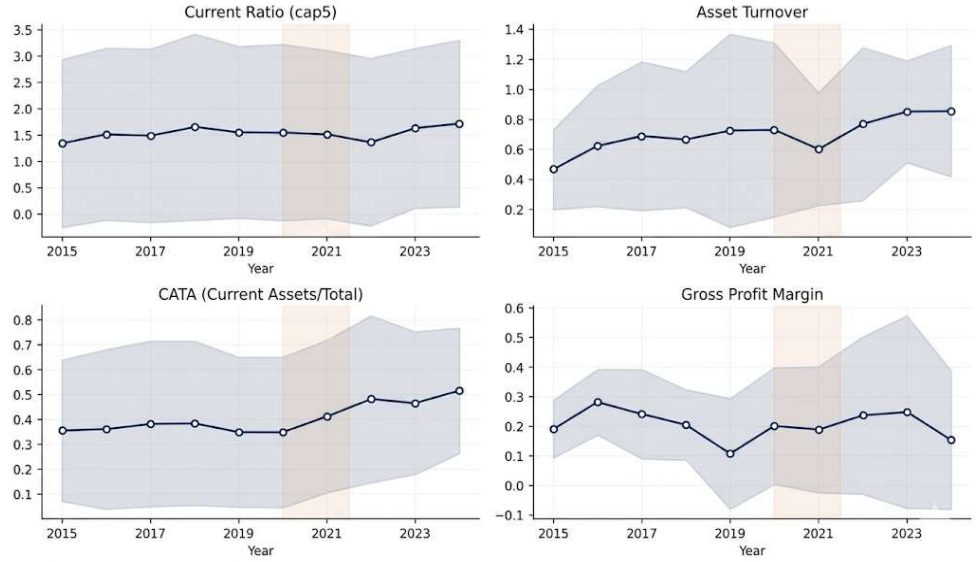

Figure 5. Temporal Trends of FAI Component Variables (9 Companies, Mean ± 1 SD) Note: Shaded area represents the COVID-19 pandemic and border closure period. Sources: MSE; Researcher's calculations.

4.5 Robustness Analysis

Table 11 reports the results of the robustness checks across various model specifications. The coefficients for the equally-weighted (β = 0.301***), lagged (β = 0.286***), and PCA-based FAI (β = 0.135***) are all positive and remain statistically significant. Notably, the significance of the lagged FAI provides empirical support for the causal direction of the relationship, mitigating potential endogeneity concerns.The loss of statistical significance in the Fixed Effects (FE) model is likely attributable to the limited within-firm variation relative to the cross-sectional variance in this small sample. Additionally, Figure 6 presents the parallel trends test for the COVID-19 shock, validating the assumptions for the impact analysis.

Table 11. Robustness Tests (Dependent Variable: ROA)

Variable	(1) Baseline OLS	(2) FE	(3) Lagged FAI	(4) PCA FAI
Equally-weighted FAI	0.3005*** (9.20)	0.1622 (1.21)		
Lagged FAI			0.2864*** (7.31)	
PCA-based FAI				0.1351*** (7.13)
Firm Size	0.0292*** (3.27)	0.0628* (1.73)	0.0319*** (3.33)	0.0269** (2.27)
Financial Leverage	-0.0680** (-2.31)	-0.0071 (-0.07)	-0.0641** (-2.11)	-0.0720** (-2.59)
RI	0.649	0.054	0.623	0.643
FirmFE	NO	YES	NO	NO

Note: Robust standard errors (HC3) are shown in parentheses *$p<0.10$, **$p<0.05$, ***$p<0.01$.

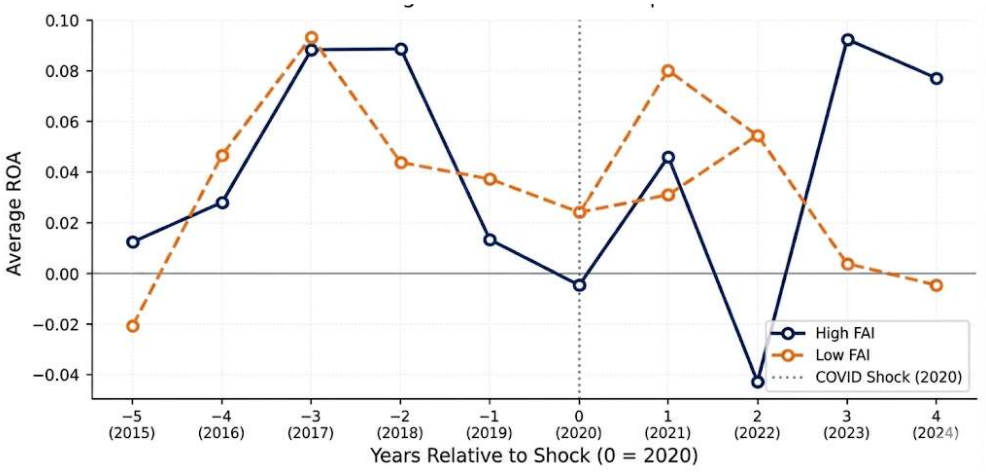

Figure 6. ROA Trends of High-FAI vs. Low-FAI Firms Before and After the COVID-19 Shock (Parallel Trends Test) Sources: MSE; Researcher's calculations.

Conclusion

This study empirically evaluates the relationship between Financial Adaptability (FAI) and corporate profitability (ROA) using a panel dataset of 90 company-years from 9 coal mining companies listed on the Mongolian Stock Exchange (MSE) for the period 2015–2024. It further examines how this relationship shifts under macroeconomic shocks, such as coal price volatility.The findings demonstrate that financial adaptability exerts a consistently positive and statistically significant impact on profitability across all model specifications (β=0.289***, t=8.86). This effect remains robust even after controlling for firm size and financial leverage, indicating that the FAI is an independent internal determinant of profitability. While the interaction analysis suggests that the FAI may serve as a buffer during coal price fluctuations and macroeconomic pressure, the lack of strong statistical significance in this regard points toward potential statistical power issues resulting from the limited sample size.Simultaneously, threshold analysis based on coal price levels reveals that the impact of adaptability is highly context-dependent. The influence of the FAI is significantly stronger during high-price (β = 0.331***) compared to low-price periods (β = 0.235***). This confirms that adaptability functions as a conditional factor that enables firms to capitalize on opportunities during growth cycles while mitigating risks during downturns.Mechanism analysis indicates that while the FAI significantly enhances short-term liquidity, specifically Current Assets to Total Assets (CATA) (β = 0.422***), CATA itself does not yield a direct statistically significant impact on profitability. This suggests that financial adaptability is a multidimensional construct that operates through

various interconnected channels rather than a single linear pathway. Robustness checks—including the use of a lagged FAI β = 0.286***; and a PCA-weighted FAI β = 0.135***) confirm that the findings are stable regardless of weighting methods or model specifications, further supporting the causal direction of the relationship.Theoretically, this research integrates financial flexibility with dynamic capabilities theory, providing the first empirical application of a multidimensional FAI index tailored to the coal mining sector. Practically, the results underscore the strategic necessity for firms to develop adaptability by safeguarding short-term liquid reserves and optimizing asset utilization in highly volatile price environments. Furthermore, in the current unstable climate where coal export prices have sharply declined from their 2022 peak of $207.3/ton—only firms with high financial adaptability are positioned to navigate the next cycle successfully. This highlights the critical requirement to treat financial adaptability as a core strategic competency of the firm.

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APPENDIX

Appendix A. Correlation Matrix

Variable	ROA	FAI	Lev	Size	GDPG	INFL	INT	SMC	CoalP
ROA	1.000	0.647***	-0.434***	0.429***	0.068	0.016	0.010	0.052	-0.035
FAI		1.000	-0.018	0.223*	0.004	-0.010	0.021	-0.007	-0.006
Leverage			1.000	-0.148	0.057	0.074	-0.002	0.154	0.094
Size				1.000	0.042	0.084	-0.022	0.100	0.065
GDPG					1.000	0.429***	0.501***	0.286***	0.509***
INFL						1.000	-0.194	0.719***	0.750***
INT							1.000	-0.271**	0.253*
SMC								1.000	0.525***
CoalP									1.000

*Тайлбар: *p<0.10, **p<0.05, ***p<0.01. Values represent Pearson correlation coefficients. Leverage has been winsorized to mitigate the impact of outliers. CoalP denotes the average coal export price ($/ton).Sources: GAC, Bank of Mongolia; Researcher's calculations.*

Appendix B. Descriptive Statistics by Company (2015–2024)

Компани	ROA mean	ROA std	ROA min	ROA max	FAI mean	FAI std	LEV mean	LEV max
Tavantolgoi JSC	0.345	0.183	0.010	0.547	0.765	0.285	0.042	1.058
Baganuur JSC	-0.018	0.043	-0.132	0.012	0.445	0.282	-0.076	0.876
Taliin Gal JSC	0.196	0.040	0.120	0.255	-0.867	0.078	-0.987	-0.746
Shariin Gol JSC	-0.012	0.058	-0.099	0.067	-0.127	0.135	-0.349	0.067
Shivee-Ovoo JSC	-0.054	0.062	-0.155	0.020	-0.322	0.187	-0.598	-0.074
Mogoin-Gol JSC	0.084	0.089	-0.047	0.261	-0.696	0.108	-0.844	-0.484
Aduunchuluun JSC	-0.055	0.118	-0.247	0.089	-0.288	0.169	-0.529	0.016
Berkh-Uul JSC	-0.194	0.225	-0.510	0.177	0.078	0.256	-0.301	0.416
Bayanteeg-JSC	0.196	0.040	0.120	0.209	-0.867	0.078	-0.987	-0.746

Sources: Researcher's calculations.

Appendix C. Complete Time-Series of Macroeconomic Variables (2015–2024)

Year	Coal Price $/ton	Coal Δ%	GDP Growth %	Inflation %	Interest Rate %	SMC/GDP %
2015	79.1		2.5	1.0	13.0	5.45
2016	55.0	-30.5	1.5	1.3	15.0	6.16

2017	81.3	+47.8	5.6	6.3	12.0	8.73
2018	100.6	+23.7	7.6	8.2	11.0	7.80
2019	93.1	-7.5	5.5	5.2	11.0	7.22
2020	55.6	-40.3	-4.4	2.3	6.0	8.19
2021	86.7	+55.9	1.6	13.5	6.5	13.73
2022	207.3	+139.1	5.0	14.2	13.0	12.79
2023	131.4	-36.6	7.2	10.3	12.0	15.94
2024	102.7	-21.8	5.0	6.8	10.0	16.21
Mean	99.3		3.7	6.9	11.0	10.22
Std	42.2		3.4	4.5	2.7	3.88

Notes: Coal Export Price is compiled from GAC, MEGM, MONTSAME, The Coal Trader, and APBI-ICMA reports. CoalΔ% = $(P_t - P_{t-1})/P_{t-1} \times 100$. GDPG: sourced from the World Bank; INFL (Inflation) from the IMF; INT (Policy Rate, end of year) from the Bank of Mongolia. SMC/GDP (Stock Market Capitalization to GDP) is based on MSE and NSO data. The final two rows report the mean and standard deviation for the 2015–2024 period.

Appendix D. Descriptive Statistics of FAI Component Variables

Variable	Mean	Std	Min	Max	Median
Current ratio	1.535	1.548	0.051	5.000	0.853
Asset Turnover	0.699	0.440	0.065	1.954	0.676
CATA	0.405	0.288	0.011	0.965	0.355
Gross porifit margin	0.205	0.193	-0.186	0.675	0.169
Equally-weighted FAI	-0.093	0.534	-0.987	1.058	-0.146
FAI (PCA)	0.000	1.259	-3.007	2.419	0.348

Note: Values are shown after capping the Current Ratio (CR) at a maximum of 5. PCA loadings for the first principal component: CR=0.680, AT=−0.533, CATA=−0.502, GPM=−0.038. PC1 accounts for 58.3% of the total variance.. Sources: MSE financial statements; Researcher's calculations.

Appendix F. Regression Results for Individual FAI Component Variables

Variable	(1)	(2)	(3)	(4)
Current ratio	0.0312*** (3.84)	0.0291** (2.76)	0.0163 (1.04)	
Asset Turnover	0.1274*** (4.17)	0.1188*** (4.35)	0.1023** (2.37)	
CATA	0.0832** (2.41)	0.0773** (2.29)	0.0415 (0.89)	
Gross porifit margin	0.2217*** (5.66)	0.2041*** (5.30)	0.1698** (2.56)	
Equally-weighted FAI				0.2890*** (8.86)
Firm size		0.0288** (2.52)	0.0601* (1.89)	0.0305*** (3.47)
Financial Leverage		-0.0631* (-2.03)	-0.0027 (-0.04)	-0.0684** (-2.38)
RI	0.607	0.648	0.151	0.648
Загварын төрөл	OLS	OLS+ctrl	FE	OLS+ctrl

*Note: HC3 robust standard errors are reported. t-statistics are in parentheses *p<0.10, **p<0.05, ***p<0.01.*