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# Multi-factor model in Taiwan's semiconductor industry

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Content

# Chapter1-Introduction

## 1.1 Research background and purpose

The Fama-French Five-Factor Model represents a significant breakthrough in asset pricing theory. Proposed by Eugene Fama and Kenneth French in 2015, the model builds upon the original Three-Factor Model by adding two additional factors: profitability (RMW: Robust Minus Weak) and investment (CMA: Conservative Minus Aggressive). These new factors reflect key financial characteristics of firms, such as profitability and investment patterns, providing a more comprehensive explanation of market anomalies. Fama and French's research demonstrated that the Five-Factor Model outperforms the Three-Factor Model in capturing systematic influences on portfolio returns, particularly when measuring the performance of small-cap and high-value firms.

**Insights:**

- **Comprehensive Return Drivers:** This model enhances the explanation of stock returns by adding profitability (RMWt) and investment (CMAt) factors to the original three factors (market risk, size, and value).
- **Profitability Impact:** Firms with higher profitability (RMWt) are rewarded with higher returns, supporting the view that robust profit generation adds to a stock's appeal.
- **Investment Behavior:** Conservative firms (CMAt) tend to outperform, suggesting that aggressive investment strategies may lead to inefficiencies or higher risks.
- **Risk Exposure Analysis:** The coefficients provide insights into a stock's exposure to different types of risks, helping in portfolio construction and risk management.
- **Alpha and Model Fit:** The model accounts for more variability in stock returns compared to the three-factor model, but any significant alpha (ait) might point to inefficiencies, skill, or omitted factors.

In this study, we build on the Fama-French Five-Factor Model to explore the asset pricing characteristics of Taiwan's semiconductor industry. As a critical player in the

global semiconductor supply chain, Taiwan's semiconductor sector is characterized by its technological intensity and high capital investment. These features may challenge the applicability of traditional value-based investment factors. Therefore, beyond the fundamental structure of the Five-Factor Model, this study incorporates industry-specific factors, such as leverage and momentum, to provide a more holistic view of the long-term determinants of investment returns in this industry. Furthermore, we compare the performance of these factors in the Taiwanese and U.S. markets to offer practical insights for investors based on historical data.

## 1.2 Research objective

The objectives of this study are as follows:：

1. Based on the Fama French five-factor model, applied to the Taiwan market and adding more factors, and compare the Taiwan semiconductor industry with the US market

2. To provide insights for those planning to invest in Taiwan semiconductor industry based on the long-term historical database

## 1.3 Research Framework and Process

This study is divided into five chapters, with the arrangement and content summarized as follows:

**Chapter 1: Introduction**

Describes the research motivation, objectives, framework, and process.

**Chapter 2: Literature Review**

Explores domestic scholars' studies on financial crisis prediction models and the definitions of financial crises provided by relevant institutions.

**Chapter 3: Research Methodology**

Explains the theoretical foundation of the logistic regression model, the research subjects, data sources, research design, and research process, including variable selection, data cleaning, and screening criteria.

**Chapter 4: Empirical Analysis**

Interprets the logistic regression model's prediction results on corporate default probabilities, identifies significant variables and prediction accuracy, and analyzes the effectiveness of the model's validation results.

**Chapter 5: Research Conclusions**

Summarizes the empirical findings and research contributions, and provides concluding remarks.

# Chapter2-literature discussion

## 2.1 Fama French's five factors model (2015)

The equation of the Fama five factors model:

$$R_{it}-R_{Ft} = a_i + b_i(R_{Mt}-R_{Ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + e_{it}.$$

Variables and Their Meanings:

1. Rit−RF: The excess return of stock iii over the risk-free rate (Rit-RF).

o This measures the return of the stock relative to a risk-free benchmark, isolating the impact of risk factors.

2. RMt−RFt: The market risk premium, which is the return of the market portfolio minus the risk-free rate.

o It reflects the compensation investors demand for taking on market risk.

3. SMBt: The size premium (Small Minus Big).

o Captures the return difference between small-cap stocks and large-cap stocks, highlighting the additional return investors expect from small firms due to their higher risk.

4. HMLt: The value premium (High Minus Low).

o Captures the return difference between high book-to-market (value) stocks and low book-to-market (growth) stocks, indicating the tendency of value stocks to outperform growth stocks.

5. RMWt: The profitability premium (Robust Minus Weak).

o Represents the return difference between stocks of companies with high profitability (robust) and those with low profitability (weak), reflecting that more profitable companies tend to deliver higher returns.

6. CMAt: The investment premium (Conservative Minus Aggressive).

o Captures the return difference between firms that invest conservatively (low asset growth) and those that invest aggressively (high asset growth). Conservative firms tend to outperform aggressive ones over time.

7. Coefficients: The sensitivities of the stock's return to each factor:

8. ait: The alpha or the portion of the stock's return unexplained by the model.

o A positive ait indicates potential outperformance or unique factors not captured by the five factors.

9. Eit: The error term, representing idiosyncratic risks or noise.

# Chapter3- Research Methodology

## 3.1 Research variable and sample

### 3.1.1 Research Samples

The research subjects and sampling period are as follows:

1. **Data Source:** Taiwan Economic Journal (TEJ) database:半導體 N
2. **Research Industries:** This study follows the industry classification of the Taiwan Stock Exchange, focusing on listed companies in the semiconductor.
3. **Number of Sample Companies:**

| Date | Number of companies |
|---|---|
| Apr-2005 | 39 |
| … | … |

| | |
|---|---|
| Sep-2024 | 83 |

4. **Sampling Period:** The study identifies companies with default records during the period from April 1, 2005, to September 30, 2024.
5. **Sample size:** 219
6. **Dependent Variable (Y):** portfolio return

### 3.1.2 Research data and factors setup

1. Retrieve stock price information for all companies during the study period.
2. Obtain financial reports for all companies during the study period.
3. Convert quarterly financial report data into monthly data.

| 該月結束日 | 名稱_right | 年/月 | 季別 | 合併(Y/N) | (Q)/單半 | 月份 | 幣別 | 稅前息前(A) | 稅後 | 稅後息前 | 綜合 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2024/09/30 | 麗正 | 2024/09 | 3 | Y | Q | 9 | NTD | 1.18 | 0.53 | 0.93 | 0.82 |
| 2024/08/30 | 麗正 | 2024/09 | 3 | Y | Q | 9 | NTD | 1.18 | 0.53 | 0.93 | 0.82 |
| 2024/07/31 | 麗正 | 2024/09 | 3 | Y | Q | 9 | NTD | 1.18 | 0.53 | 0.93 | 0.82 |
| 2024/06/28 | 麗正 | 2024/06 | 2 | Y | Q | 6 | NTD | 2.15 | 1.33 | 1.71 | 1.26 |
| 2024/05/31 | 麗正 | 2024/06 | 2 | Y | Q | 6 | NTD | 2.15 | 1.33 | 1.71 | 1.26 |
| 2024/04/30 | 麗正 | 2024/06 | 2 | Y | Q | 6 | NTD | 2.15 | 1.33 | 1.71 | 1.26 |

4. Construction of the factors.
5. Standardize the data.
6. Perform univariate analysis on each independent variable with the dependent variable.
7. Build a correlation matrix to analyze the relationships between independent variables. Remove one variable from pairs with a correlation coefficient greater than 0.7. The variable with the smaller p-value in the univariate analysis is retained. Variables such as 'PEG', 'RMW', 'ROA', and 'LIQ' are removed.

8.Change 'RD', 'WML', 'INV_TURN', 'QUICK', 'COV' as dummy variables, because they are not very significant in the first try of regression model

9. Conduct stepwise regression on the selected independent variables to identify those that have a significant impact on the multiple regression model.

## 3.2 Theoretical Model

### 3.2.1 Research Model

This study employs a multiple regression model to see the sensitivity of each factor with the portfolio return.

# Chapter4- Research Methodology

## 4.1 Selection of variable and factors

| Factor | Variable |
|---|---|
| MKT_RF (market) | Market returns minus risk free rate |
| SMB (Size) | Market value of firms |
| HML (Value) | B/M ratio |
| RMW (profitability) | ROE |
| LEV (leverage) | D/E ratio |
| WML (momentum) | Average return of pass 12months |
| ROA | ROA |
| GM | Gross margin |
| COV | Coverage ratio |
| INV_TURN | Inventory Turnover |
| PEG | Price/Earnings to Growth |
| RD | Research & Development |
| TURN | Turnover Ratio |
| LIQ | Liquidity Ratio |
| QUICK | Quick ratio |
| Y (Portfolio return-Rf) | |

## 4.2 Calculation of factors and Y

**Y= Portfolio return-Rf**

Definition:

The dependent variable ($Y$) represents the monthly stock returns of companies in the Taiwanese semiconductor industry.

# 1. Method1

## (consideration into size effect, based on the fama's calculation)

Example: HML

Step 1: Remove missing data

Step 2: Group by Size (Small vs. Big)

Step 3:

Categorize companies into three BM ratio groups for each time point:

- **Low BM**: Bottom 30%.
- **Middle BM**: Middle 40%.
- **High BM**: Top 30%

Step 4: Combine size and BM ratio

Step 5: Calculate value-weighted returns

Step6: Calculate the Value Factor (HML):

$$R_{\text{High}} = \frac{R_{\text{Small\_High}} + R_{\text{Big\_High}}}{2}$$

$$R_{\text{Low}} = \frac{R_{\text{Small\_Low}} + R_{\text{Big\_Low}}}{2}$$

$$\text{HML} = R_{\text{High}} - R_{\text{Low}}$$

**Applied factors: HML, RMW**

# 2. Method2

## (Without consideration of size effect, divide by 30%, 40%, 30%)

**Step 1:** Remove missing data

**Step 2:** Categorize Gross margin (GM)

Low: Bottom 30% (lowest gross margin).

Middle: Middle 40% (moderate gross margin).

High: Top 30% (highest gross margin).

**Step3:** Calculate Value-Weighted Returns for the Low Gross Margin Group

$$R_{\text{High}} = \frac{\sum(\text{Return} \times \text{Market Cap})}{\sum \text{Market Cap}}$$

$$R_{\text{Low}} = \frac{\sum(\text{Return} \times \text{Market Cap})}{\sum \text{Market Cap}}$$

**Step4:** Compute the Gross Margin Factor (GM)

$$\text{GM} = R_{\text{High}} - R_{\text{Low}}$$

**Applied factors: SMB, QUICK, LIQ, COV, GM, RMW, PEG, INV_TURN, SMB, ROA, RD, TURN, WML, HML**

## 3. Method3

## (Without consideration of size effect, divided by 5 groups)

Example: LEV

**Step 1:** Remove missing data

- Exclude entries with missing debt ratios.

**Step 2:** Categorize by leverage (Debt ratio)

- Divide companies into 5 groups using quintiles: "Low," "L2," "M," "H2," and "High."
- Use only the **highest 20% (High)** and **lowest 20% (Low)** groups for the calculation.

**Step 3:** Calculate value-weighted returns

- **High Leverage Group**
- **Low Leverage Group**

**Step 4:** Calculate LEV

**Applied factor: LEV**

## **4.3** Result analysis

Table1. single factor analysis

| Variable | P-Value |
|---|---|
| MKT_RF | 1.01E-57 |
| QUICK | 7.92E-11 |
| LEV | 6.69E-10 |
| LIQ | 1.17E-08 |
| COV | 7.87E-06 |
| GM | 2.27E-05 |
| RMW | 0.000953 |
| PEG | 0.002435 |
| INV_TURN | 0.018341 |
| SMB | 0.013504 |
| ROA | 0.02167 |
| RD | 0.030695 |
| TURN | 0.042819 |
| WML | 0.261677 |
| HML | 0.419913 |

**Table2. Correlation matrix**

| | WML | RMW | HML | SMB | LEV | ROA | GM | COV | INV_TURN | PEG | RD | TURN | LIQ | QUICK | MKT_RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WML** | 1.000 | 0.302 | -0.292 | -0.084 | -0.079 | 0.309 | 0.203 | 0.241 | 0.069 | -0.290 | 0.032 | 0.107 | -0.057 | 0.028 | -0.179 |
| **RMW** | 0.302 | 1.000 | -0.457 | -0.266 | -0.292 | 0.871 | 0.694 | 0.693 | 0.315 | -0.843 | 0.072 | -0.218 | 0.047 | 0.189 | -0.286 |
| **HML** | -0.292 | -0.457 | 1.000 | 0.088 | 0.045 | -0.376 | -0.320 | -0.290 | 0.032 | 0.356 | -0.209 | 0.009 | -0.117 | -0.151 | 0.029 |
| **SMB** | -0.084 | -0.266 | 0.088 | 1.000 | -0.320 | -0.341 | -0.139 | -0.024 | -0.113 | 0.330 | -0.129 | 0.615 | 0.460 | 0.334 | 0.183 |
| **LEV** | -0.079 | -0.292 | 0.045 | -0.320 | 1.000 | -0.293 | -0.523 | -0.612 | -0.414 | 0.350 | 0.153 | -0.187 | -0.551 | -0.686 | 0.130 |
| **ROA** | 0.309 | 0.871 | -0.376 | -0.341 | -0.293 | 1.000 | 0.760 | 0.738 | 0.361 | -0.913 | 0.019 | -0.236 | 0.012 | 0.162 | -0.224 |
| **GM** | 0.203 | 0.694 | -0.320 | -0.139 | -0.523 | 0.760 | 1.000 | 0.868 | 0.445 | -0.756 | 0.080 | -0.109 | 0.219 | 0.356 | -0.216 |
| **COV** | 0.241 | 0.693 | -0.290 | -0.024 | -0.612 | 0.738 | 0.868 | 1.000 | 0.476 | -0.717 | 0.031 | -0.009 | 0.254 | 0.389 | -0.213 |
| **INV_TURN** | 0.069 | 0.315 | 0.032 | -0.113 | -0.414 | 0.361 | 0.445 | 0.476 | 1.000 | -0.330 | 0.223 | -0.239 | 0.133 | 0.323 | -0.066 |
| **PEG** | -0.290 | -0.843 | 0.356 | 0.330 | 0.350 | -0.913 | -0.756 | -0.717 | -0.330 | 1.000 | 0.071 | 0.254 | -0.095 | -0.234 | 0.240 |
| **RD** | 0.032 | 0.072 | -0.209 | -0.129 | 0.153 | 0.019 | 0.080 | 0.031 | 0.223 | 0.071 | 1.000 | 0.019 | -0.202 | -0.087 | 0.034 |
| **TURN** | 0.107 | -0.218 | 0.009 | 0.615 | -0.187 | -0.236 | -0.109 | -0.009 | -0.239 | 0.254 | 0.019 | 1.000 | 0.069 | -0.003 | 0.268 |
| **LIQ** | -0.057 | 0.047 | -0.117 | 0.460 | -0.551 | 0.012 | 0.219 | 0.254 | 0.133 | -0.095 | -0.202 | 0.069 | 1.000 | 0.844 | -0.071 |
| **QUICK** | 0.028 | 0.189 | -0.151 | 0.334 | -0.686 | 0.162 | 0.356 | 0.389 | 0.323 | -0.234 | -0.087 | -0.003 | 0.844 | 1.000 | -0.164 |
| **MKT_RF** | -0.179 | -0.286 | 0.029 | 0.183 | 0.130 | -0.224 | -0.216 | -0.213 | -0.066 | 0.240 | 0.034 | 0.268 | -0.071 | -0.164 | 1.000 |

### 4.3.1 Final model

(1) Description: Model incorporates six quantitative variables and one qualitative variable (1 for having positive momentum).

(2) Result of multiple regression：

| | | | |
|---|---|---|---|
| Dep. Variable: | Portfolio_return_rf | No. Observations: | 219 |
| Model: | OLS | Df Residuals: | 211 |
| Method: | Least Squares | Df Model: | 7 |
| Date: | 12/22/2024 | R-squared: | 0.862 |
| Time: | 02:46:50 | Adj. R-squared: | 0.858 |
| Log-likelihood | -93.529 | AIC: | 203.1 |
| Covariance Type: | nonrobust | BIC: | 230.2 |

| | coef | std err | t | P > \|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Const | -0.05 | 0.036 | -1.380 | 0.169 | -1.783 | 0.128 |
| HML | -0.0702 | 0.028 | -2.541 | 0.012 | 0.562 | 1.719 |
| SMB | -0.3604 | 0.035 | -10.222 | 0.000 | -2.063 | -0.192 |
| LEV | 0.1721 | 0.035 | -2.227 | 0.000 | -2.062 | -0.131 |
| GM | -0.0721 | 0.035 | -2.086 | 0.038 | -1.682 | -0.027 |
| TURN | 0.1543 | 0.034 | 4.582 | 0.000 | -1.624 | 0.449 |
| MKT_RF | 0.8274 | 0.028 | 30.022 | 0.000 | 0.773 | 0.882 |
| WML_dummy | 0.1033 | 0.053 | 1.943 | 0.053 | -0.001 | 0.208 |

(3) Model Equation：

Portfolio_return_Rf = -0.05 -0.0702 HML (value factor)- 0.3604SMB (size factor) + 0.1721 LEV (leverage factor) - 0.0721 GM (gross margin factor) - 0.1543TURN (turnover ratio) + 0.8274 Mkt_Rf+ 0.1033 WML_dummy (momentum factor)

(4) Insight of the variable

| Factors | Variable inside | Coef. | Economic meaning |
|---|---|---|---|
| HML | B/M ratio | -0.0702 | V |
| SMB | Value size | -0.3604 | V |
| LEV | Debt ratio | 0.1721 | V |
| GM | Gross profit/Revenue | -0.0721 | V |
| TURN | COGS/Av. Inv | -0.1543 | V |
| Mkt_Rf | Market premium | 0.8274 | V |
| WML_dummy | Last 12 months Average return | 0.1033 | V |

## 4.3.2 Explanation of Model Results

### (1) HML

**Description:** This factor measures the return difference between high book-to-market (value) stocks and low book-to-market (growth) stocks.

**Model Insight:** The coefficient of -0.0702 indicates that growth stocks (low B/M) slightly outperform value stocks (high B/M) in this analysis.

**Comparison to Fama-French:** In the original Fama-French model, HML often shows a positive relationship, reflecting value stocks' tendency to outperform growth stocks. However, the sign and magnitude of this factor can vary by market and sector.

**Possible Reasons:**

i The semiconductor industry is innovation-driven, where growth stocks often represent companies investing heavily in R&D and future technology, making them more attractive to investors.

ii High B/M firms may be older, more mature companies with slower growth prospects, leading to lower returns in this sector.

iii Investor sentiment in the Taiwanese semiconductor market may favor high-growth, low B/M companies, particularly during periods of technological advancements or market optimism.

**(2) SMB**

**Description:** This factor captures the return difference between small-cap and large-cap stocks.

**Model Insight:** The coefficient of -0.3604 suggests that large-cap stocks outperform small-cap stocks in the context of this analysis.

**Comparison to Fama-French:**

The Fama-French model often finds a positive SMB coefficient globally, indicating that small-cap stocks outperform. This deviation could reflect specific preferences or dynamics in the Taiwanese semiconductor industry.

i Large-cap semiconductor companies in Taiwan (e.g., TSMC) often dominate the global market, benefiting from economies of scale, stronger supply chains, and better access to capital.

ii Small-cap firms may lack the resources to compete in a highly capital-intensive industry, leading to lower investor confidence and returns.

iii The market may perceive large-cap firms as safer investments during periods of economic uncertainty or industry volatility.

**(3) LEV**

**Description:** This factor measures the return difference between high-leverage (high debt-to-equity ratio) and low-leverage companies.

**Model Insight:** A positive coefficient of 0.1721 indicates that high-leverage firms tend to perform better than low-leverage firms.

**Comparison to Fama-French:** Leverage is not a part of the Fama-French five factors. Including this factor provides additional insights into the influence of capital structure on stock returns.
Possible Reasons:

I. High leverage may indicate aggressive expansion strategies, which can lead to higher returns if the borrowed capital is used effectively.

II. Semiconductor firms with high debt levels might be viewed as taking calculated risks to maintain or expand market share, which investors reward.

III. Low-leverage companies might represent firms that are too conservative, missing out on growth opportunities in a competitive, rapidly evolving industry.

**(4) GM**

**Description:** This factor compares the performance of firms with high operating gross margins against those with low margins.

**Model Insight:** The coefficient of -0.0721 suggests that lower-margin companies slightly outperform higher-margin companies

**Possible Reasons:**

Companies with lower gross margins may be pricing their products competitively, driving higher revenue growth and market share, which appeals to investors. High-margin firms might face slower growth due to mature product lines or less competitive pricing strategies.

- In the semiconductor industry, lower-margin firms may represent contract manufacturers or suppliers operating at high volumes, translating into higher overall

**(5) TURN**

**Description:** This factor reflects the relationship between turnover efficiency and returns.

**Model Insight:** A positive coefficient of -0.1543 indicates that firms with lower inventory turnover rates tend to generate higher returns.

**In general:**

- higher turnover ratio indicates efficient inventory management, suggesting that the company quickly sells and replenishes inventory.
- A lower turnover ratio may signal inefficiencies, such as overstocking or slow-moving inventory.

**For semiconductor companies:**

- A high turnover ratio might indicate rapid product cycles and strong demand for components, but it can also reflect commoditized, low-margin products.

- A low turnover ratio could signal a focus on high-value, innovative products that take longer to sell but generate higher profitability.

I think this can explain how firms with lower inventory turnover rates tend to generate higher returns.

**(6) Mkt_Rf**

**Description:** This factor represents the market risk premium, calculated as the return difference between the market and the risk-free rate.

**Model Insight:** A strong positive coefficient of 0.8274 suggests that the overall market return significantly influences portfolio returns.

**(7) WML_dummy**

**Description:** This factor measures the return difference between high-momentum stocks and low-momentum stocks.

**Model Insight:** The positive coefficient of 0.1033 indicates that high-momentum stocks tend to outperform low-momentum stocks in this analysis.

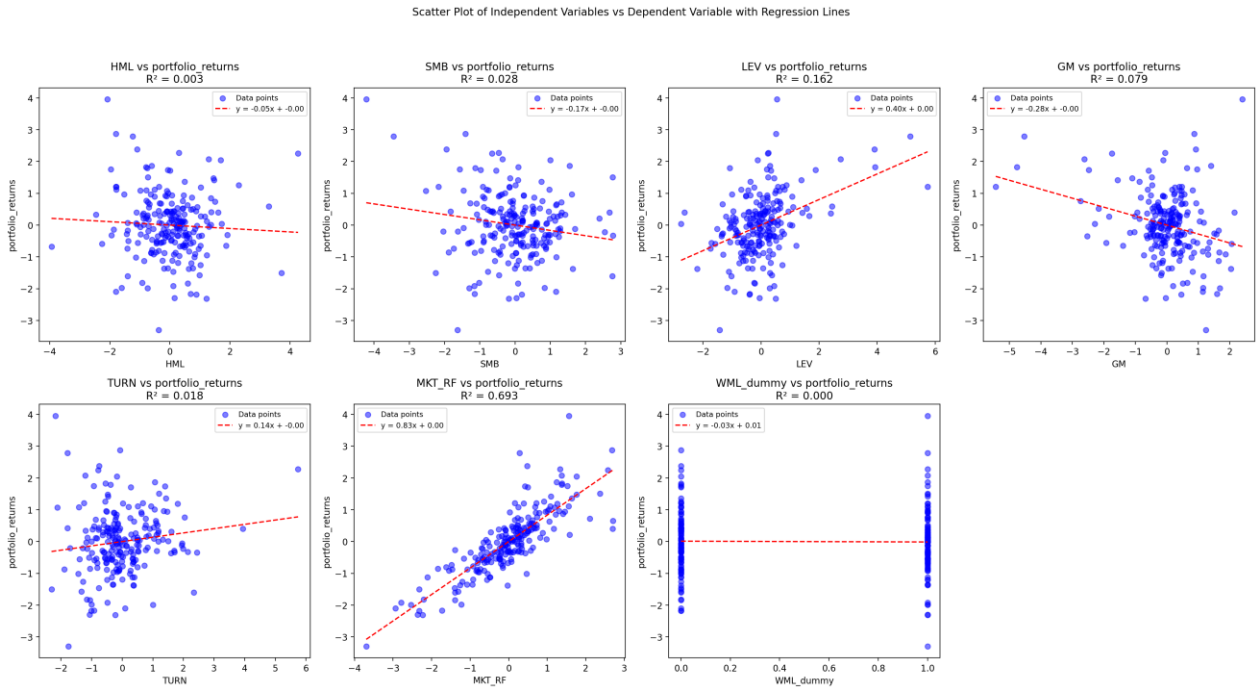
**Possible Reasons:**

i In the semiconductor industry, companies with recent strong performance may signal innovation, successful product launches, or favorable market conditions, attracting more investor attention.

ii Investors may have higher confidence in firms with positive recent trends, reinforcing the momentum effect.

## 4.3.3 Checking Assumption

**(1) Checking Linearity**




## (2) Checking multicollinearity

| Variable | VIF |
|---|---|
| Const | 2.015684 |
| HML | 1.169000 |
| SMB | 1.906922 |
| LEV | 1.827382 |
| GM | 1.831181 |
| TURN | 1.739764 |
| MKT_RF | 1.165082 |

**All variables' VIF values are within acceptable range.**

**Conclusion:**

## (3) Checking autocorrelation

Durbin-Watson statistic: 1.9947 (close to 2)

Conclusion: No significant autocorrelation

## (4) Checking Homoscedasticity

Breusch-Pagan Test Results

Lagrange multiplier statistic: 16.5328

p-value: 0.0207

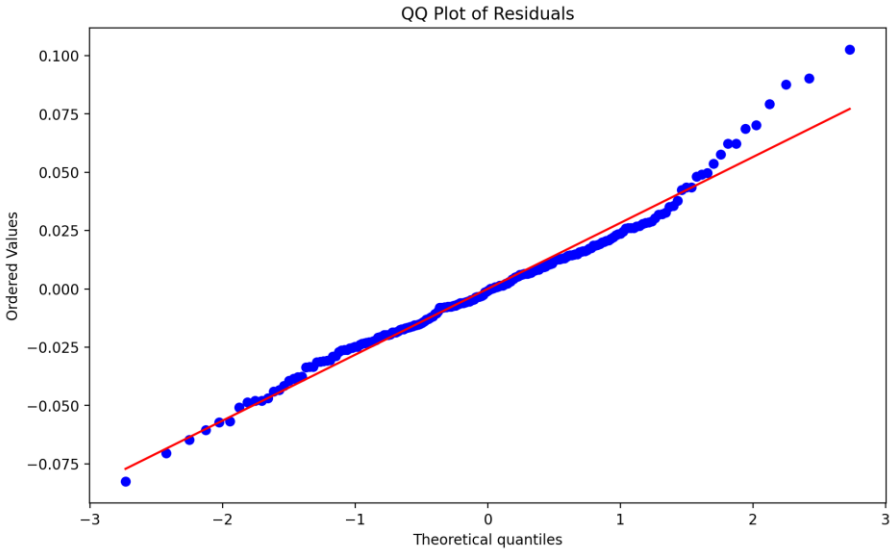
f-value: 2.4614

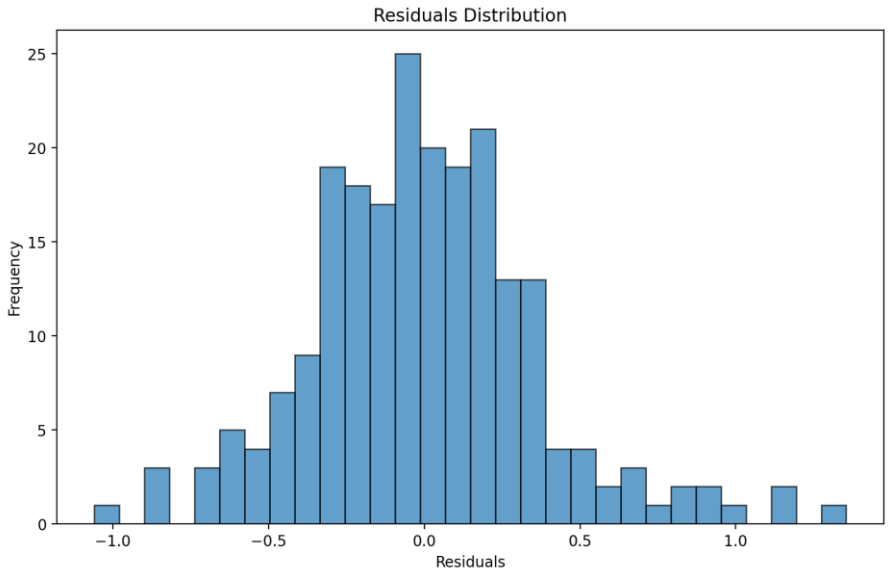
f p-value: 0.0190

Breusch-Pagan Test Interpretation:

**Result: Heteroscedasticity is present (reject H0)**

**(5) Checking Normally distributed in residuals**




Kolmogorov-Smirnov Test Interpretation:

**Conclusion: Residuals are NOT normally distributed**

## 4.3.4 The regression of 30% of the sample

### 4.3.4.1 The original model

```
=== ANOVA Table for Full Model ===

Sample Size: 219.0

ANOVA Summary:
                  SS     df       MS         F  p-value
Source
Regression  188.8755    7.0  26.9822  188.9908      0.0
Residual     30.1245  211.0   0.1428       NaN      NaN
Total       219.0000  218.0      NaN       NaN      NaN

Model Summary Statistics:
R-squared: 0.8624
Adjusted R-squared: 0.8579
```

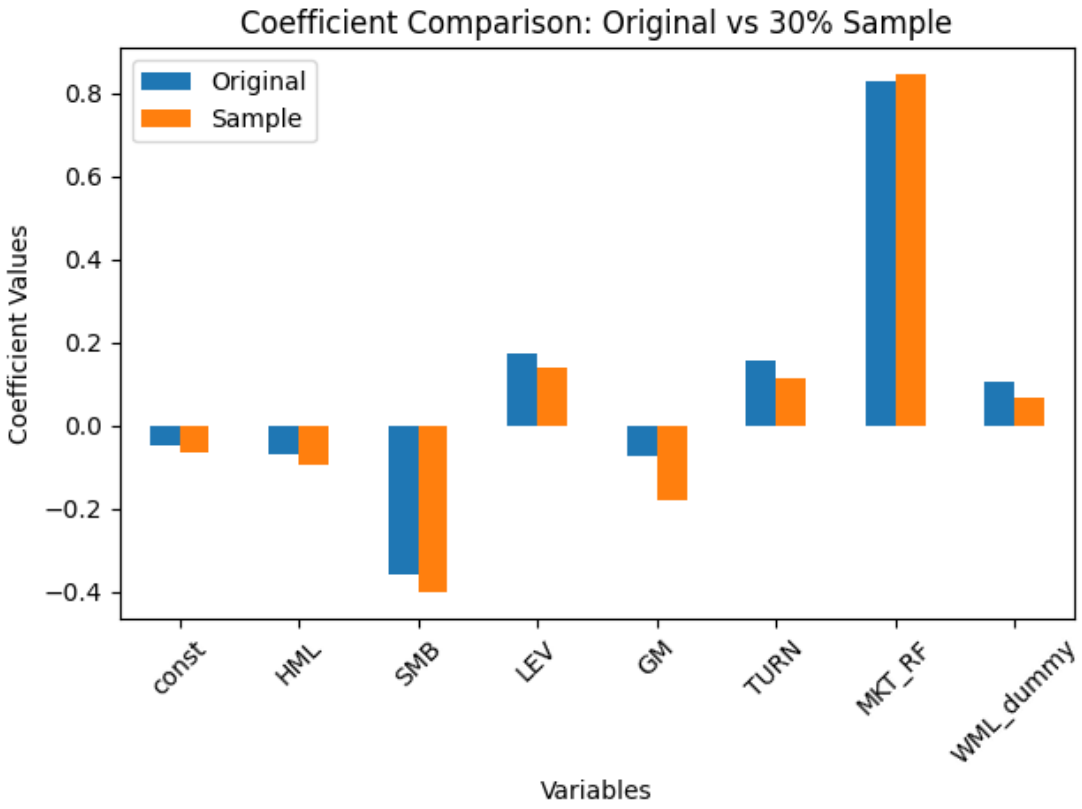
### 4.3.4.2 Sample of model

```
=== ANOVA Table for 30% Sample Regression ===

ANOVA Summary:
                 SS    df      MS        F  p-value
Source
Regression  59.3811   7.0  8.4830  82.1213      0.0
Residual     8.1606  79.0  0.1033      NaN      NaN
Total       67.5416  86.0     NaN      NaN      NaN

Additional Model Statistics:
R-squared: 0.8792
Adjusted R-squared: 0.8685

Mean Squared Error (MSE) for 30% Sample: 0.1030
```

**Percentage change:**

MSE change: (0.1428-0.103)/0.1428=27.87%

### 4.3.4.3 Coefficient Change:




# Chapter5- Research Conclusions and Recommendations

## 5.1 Conclusion:

### 5.1.1 Problem remains:

- Doesn't meet the Assumption
- Not enough database, hard to get the long-term data like the US
- Hard to interpret for all factors

### 5.1.2 Comparison with the original five model

- RMW (not significant in Taiwan's semiconductor industry)
- CMA (based on the asset growth ratio) the missing value is remained to solve
- Market and Momentum are needed to consider

### 5.1.3 Recommendation for those who wants to invest in semiconductor industry

i **Focus on Market Leaders**

Insight: The model indicates that large-cap companies (negative SMB) in the Taiwanese semiconductor industry tend to outperform.

Recommendation:

Prioritize investments in established, large-cap firms with strong market dominance, as they are likely to offer more stable and consistent returns.

ii **Consider Leverage as an Opportunity**

Insight: High-leverage firms (positive LEV) perform better, potentially reflecting aggressive expansion strategies.

Recommendation:

Look for companies that effectively utilize leverage to fund growth and innovation, as these are more likely to generate higher returns.

iii **Be Cautious of Value and Growth Dynamics**

Insight: Growth stocks (negative HML) outperform value stocks in this sector.

Recommendation: Focus on companies with low book-to-market ratios (growth-oriented firms), which are more likely to thrive in the innovation-driven semiconductor industry.

iv **Momentum Trends**

Insight: High-momentum stocks (positive WML_dummy) outperform low-momentum ones.

## 5.2 Reference:

**“Fama and French, “A Five-Factor Asset Pricing Model.”**

(Fama & French, 2015)