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# Are retail or institutional investors' shareholdings and market turnover ratio determinants of the negativity of the security market line in the Taiwan stock?

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## ABSTRACT

This study investigates the curvature of the Security Market Line (SML) and examines whether retail or institutional investors play a key role in shaping the SML in the Taiwan stock market. The empirical results of Fama-MacBeth regression reveal a negative SML slope in the Taiwan stock market. In addition, the overconfident hypotheses on market turnover ratio, retail investors, and three types of institutional investors are examined. The results indicate that unsophisticated (retail) investors are more influential than the market turnover ratio in shaping the negativity of the SML. By contrast, institutional investors tend to support a positive traditional SML in the Taiwan stock market.

## Keywords:

Security market line, Investor overconfidence, Retail investor, Institutional investor, Market turnover.

# 1 | Introduction

The capital asset pricing model proposes an upward-sloping security market line (SML; Lintner, 1965; Sharpe, 1964). In recent years, the curvature of the SML in the US stock market has positively flattened (Ang & Kristensen, 2012; Baker *et al.*, 2011; Frazzini & Pedersen, 2014). However, the emerging stock market of China has demonstrated a highly negative downward-sloping SML (Han, *et al.*, 2020). In February 2024, the Taiwan stock market, a major market among emerging financial markets, reached a capital of US$2 trillion. Its SML demonstrated negativity, indicating that its low-beta portfolio is more profitable than its high-beta portfolio (low-beta anomaly), which may have major investment implications for mutual fund, exchange-traded funds, and individual investors.

To address low-beta anomalies, researchers have proposed the overconfidence hypothesis, which posits that excessive trading in a stock market would make low-beta portfolios have more returns than those of high-beta portfolios. Although many studies have employed market turnover ratio or retail investors as a proxy for testing this hypothesis, few studies have directly compared these two variables or compared retail and institutional investors.

Barber and Odean (2000) examined the relationship between trading frequency and investment returns. They discovered that retail investors with high turnover rates underperformed in the market, a behavior attributable to overconfidence. Therefore, they suggested that overconfident investors should trade more frequently to increase their turnover ratios and decrease their net returns. Statman *et al.* (2006) explored the effect of overconfidence on trading volume and reported that overconfidence was associated with increased trading activity and market turnover ratios. They provided empirical evidence linking overconfidence to trading volume for both retail and institutional investors. Chen *et al.* (2007) examined the behavior of investors in the Chinese stock market and discovered that high turnover ratios were indicative of overconfident trading behavior, particularly among retail investors. Glaser and Weber (2007) explored the relationship between overconfidence and trading volume through survey data. They reported that overconfident investors traded frequently, resulting in increased turnover ratios. Baker *et al.* (2011) and Daniel and Hirshleifer (2015) have argued that investor overconfidence, as measured by excessive trading, could provide an intrinsic explanation for the successful Betting Against Beta (BAB) strategy. Prosad *et al.* (2015) examined the prevalence of behavioral biases, including overconfidence, among retail investors in India. They reported that overconfidence significantly affects trading behavior, leading to increased market turnover ratios. Han and Li (2017) examined the Chinese stock market and revealed that private information or trading skills may have caused unsophisticated or retail investors to be overconfident in risky assets. Han *et al.* (2020) proposed market turnover ratio as a proxy for investor overconfidence and validated this ratio for use in the Chinese stock market. Overconfidence bias may cause investors to underestimate the actual risk and overinvest in speculative assets, causing more risky assets to be less profitable.

Chiu *et al.* (2018) examine a liquidity-based strategy designed to outperform traditional beta-based investment approaches. By integrating liquidity measures into the betting-against-beta strategy, the study reveals

significant abnormal returns across various liquidity-sorted portfolios. In terms of the Taiwan stock market, Chiou (2018) reported that the BAB strategy could yield positive returns for the Top 50 Taiwanese firms, but not for the Top 51-150 Taiwanese firms. Chen (2019) demonstrated the existence of the phenomenon of low-risk anomalies and reported that the BAB strategy could generate excess returns. Dai (2020) combined the BAB strategy with liquidity risks and discovered that long-term and short-term portfolios can significantly reduce portfolio volatility and increase Sharpe's ratio. These findings are consistent with the concept of low-beta anomalies.

Although many studies have explored beta anomalies by comparing the net returns of high- and low-beta portfolios in the Taiwan stock market, few studies have examined the curvature of the SML and the distinct effects of retail and institutional investors on the shape of the SML. Typically, three types of institutional investors operate in the Taiwan stock market: Qualified Foreign Institutional Investors (QFII), Securities Investment Trust investors (SIT), and Securities Firm Dealers (SFD). Variations in the shareholding ratios or trading behaviors of these three types of investors may have distinct effects on the curvature of the SML, warranting further examination.

This study investigates the curvature of the SML and verifies the effects of market turnover, retail investors, and three types of institutional investors on the slope of the SML in the Taiwan stock market. The research procedure is outlined as follows. First, a method proposed by Frazzini and Pedersen (2014) is used to conduct Fama-MacBeth cross-sectional regression analyses at the firm level for each month. Subsequently, the time-series averages of the regression coefficients of the intercept and slope of the SML are reported, and the negativity of the SML slope is verified for the Taiwan stock market. Second, to test the overconfidence hypothesis, the regression coefficients of the monthly time series (i.e., intercept and slope) are regressed on the turnover ratio and the retail and institutional investor shareholding ratios. Finally, the concluding remarks are summarized.

# 2 | Data and methodology

## 2.1 Data sources and variable definitions

Equity and financial data are retrieved from the Taiwan Economic Journal (TEJ) database. To obtain market beta series, the daily stock returns of all listed stocks and market returns over the period from January 2003 to December 2023 are collected from the TEJ Equity database. In addition, monthly stock returns, market returns, balance sheets, and income statements from January 2008 to December 2023 are obtained from the TEJ Equity and TEJ Financial databases, respectively. Because the data of institutional investors are available starting from January 2008 in the TEJ database, the monthly individual stock turnover ratios and the holding ratios of retail and institutional investors are collected for the period from January 2008 to December 2023. After incomplete data is eliminated, a total of 1,571 firms whose data are available in the TEJ database are sampled. The monthly rate of a 1-year time-deposit in the Bank of Taiwan is used as a proxy for the risk-free rate.

The study variables are defined as follows:

(1) RET is the dependent variable, calculated as the monthly stock returns minus the monthly risk-free rate.

(2) Beta is the product of correlation and the ratio of stock return standard deviation to market return standard deviation (Frazzini & Pedersen, 2014; Han *et al.*, 2020). Time-series beta is defined as follows:

$$\hat{\beta}_i^{TS} = \hat{\rho} \times \frac{\hat{\sigma}_i}{\hat{\sigma}_m} \tag{2.1}$$

A beta index is derived for analysis, and the derivation process is as follows: First, correlations typically move much slower than conditional volatility does. Therefore, to control for nonsynchronous trading, overlapping 3-day log returns are used as daily stock returns, and market-adjusted returns are calculated using 1-day log returns. Subsequently, the previous 5-year daily series of these two returns are used to calculate the correlation ($\hat{\rho}$) of each individual stock per month:

$$r_{it}^{3d} = \sum_{k=0}^{2} \ln(1 + r_{t+k}^{i}) \tag{2.2}$$

Second, the previous 1-year daily returns in both stock ($\hat{\sigma}_i$) and adjusted ($\hat{\sigma}_m$) market returns are used to calculate the standard deviation. Data are specifically compiled to obtain at least 6 months of non-missing data for estimating volatility standard deviations and at least 3 years of nonmissing data for estimating correlations.

Third, to avoid outliers, Vasicek (1973) suggested the reduction of the time-series estimate of beta $\beta_i^{TS}$ toward the cross-sectional mean $\beta^{XS}$:

$$w_i \hat{\beta}_i^{TS} + (1 - w_i)\hat{\beta}^{XS} \tag{2.3}$$

According to Frazzini and Pedersen (2014) and Han et al. (2020), $w_i$ = 0.6 and $\hat{\beta}^{XS} = 1$.

(3) LnME is the natural logarithm of a firm's market capitalization measured in year t-1.

(4) LnBTM is the natural logarithm of a firm's book-to-market value measured in year t-1.

(5) OP refers to operational profitability, defined as the ratio of operational profits to book equity, measured in year t-1 (Fama & French, 2017).

(6) INV refers to asset investment, defined as the growth rate of total assets in year t-1 (Fama & French, 2017).

(7) $RET^{MOM}$ refers to intermediate-term return momentum, defined as the past 12-month cumulative return, skipping the most recent month (Fama & French, 2012).

(8) $RET^{STREV}$ refers to short-term return reversal, defined as the previous 1-month stock returns (Jegadeesh & Titman, 1993).

(9) TURN is the market turnover ratio, defined as the lagged value-weighted monthly stock turnover ratio.

(10) QFII is the lagged value-weighted monthly stock shareholding ratio of qualified foreign institutional investors.
(11) SIT is the lagged value-weighted monthly stock shareholding ratio of securities investment trust investors.
(12) SFD is the lagged value-weighted monthly stock shareholding ratio of securities firm dealers.
(13) INST is the sum of the shareholding ratios of the three aforementioned institutional investors.
(14) RETL is the shareholding ratio of retail investors, defined as 1-INST.
(15) INS_NBS is the lagged value-weighted monthly stock of the total net buy and sell amounts of institutional investors.
(16) INS_TR is the lagged value-weighted monthly stock of the total trading ratio of institutional investors.

## 2.2 Empirical Fama-Macbeth regression model

To measure the curvature of the SML in Taiwan, Fama-Macbeth cross-sectional regression is applied as follows (Han *et al.*, 2020):

$$RET_i - RF = b_0 + b_1\beta_i + b_2\, LnME_i + b_3\, LnBTM_i + b_4\, OP_i + b_5\, INV_i + b_6\, RET_i^{MOM} + b_7\, RET_i^{STREV} + \varepsilon_i \quad (2.4)$$

In this equation, a negative slope coefficient for the beta regressor (b1) and a positive intercept term (b0, also referred to as the alpha coefficient) are indicative of a downward-sloping SML. The alpha coefficient is used to determine whether the realized return differs from the required return, as determined by the traditional capital asset pricing model. In this study, to test the robustness of the slope coefficient (b1), four hierarchical sub-regression models are specified. All predetermined variables are winsorized at the 0.5% and 99.5% levels on both extremes (Tukey, 1977). A total of 240,364 monthly observations across all firms from January 2008 to December 2023 are included in the study. After the four sub-regression models are estimated for each month, the time-series averages of the cross-sectional regression coefficients are summarized.

## 2.3 Empirical model for validating overconfidence

According to Han *et al.* (2020), the slope of the SML has a negative relationship with overconfidence, but the intercept term has a positive relationship with overconfidence. In this study, to test the overconfidence hypothesis, a two-step standard procedure (Jylhä, 2018) is applied. In the first step, the following equation is proposed and executed per month:

$$RET_{it} - RF_t = Intercept_t + Slope_t\, \beta_{it} + b_2\, LnME_i + \varepsilon_{it} \quad (2.5)$$

In the second step, the empirical results of $Intercept_t$ and $Slope_t$ are used as the dependent variables. As indicated by Jylhä (2018), the Intercept and Slope of the SML represent a zero-cost, zero-beta portfolio and a zero-cost, unit-beta portfolio, respectively. In this study, market turnover ratio and retail and institutional investors (i.e., lagged value-weighted TURN, QFII, SIT, SFD, INST, and RETL) are used to test the investor overconfidence hypothesis. To ensure validity, four risk factors are adopted as control variables ($Z_t$). Notably, excess market returns, return momentum ($RET^{MOM}$), and return

reversal ($RET^{STREV}$) are not included as control variables in (2.6) and (2.7) because the beta regressor ($\beta_{it}$) is derived from the correlation between individual stock returns and market returns and their standard deviations. All explanatory variables are standardized with a mean of 0 and a standard deviation of 1.

Because market turnover ratio is an appropriate proxy for explaining investor overconfidence, this study primarily focuses on the shareholding ratios of retail and institutional investors. Two empirical models are established and compared. The first model consists of a single hypothesized variable (X1), namely X1 = TURN, QFII, SIT, SFD, INST, or RETL. In the following equations, the Z vector represents controlled variables, *a* and *b* represent regression coefficients, and *D*′ represents a vector:

$$Intercept_t = a_1 + b_1 X1_{t-1} + D_1' Z_{t-1} + \upsilon_{it} \quad (2.6)$$

and

$$Slope_t = a_2 + b_2 X1_{t-1} + D_2' Z_{t-1} + \upsilon_{it} \quad (2.7)$$

The overconfidence hypothesis posits that any increase in $X1_{t-1}$ would have a positive effect on the Intercept (i.e., $b_1 > 0$), whereas any increase in $TURN_{t-1}$ would have a negative effect on the Slope (i.e., $b_2 < 0$)).

To verify whether the turnover ratio and retail or institutional investor overconfidence have joint effects, the second model is designed as a combined model that contains two hypothesized variables (TURN, and X2), namely, X2 = QFII, SIT, SFD, INST, or RETL. In the following equations, the Z vector represents controlled variables and a, b, and D represent regression coefficients.

$$Intercept_t = a_1 + b_1 TURN_{t-1} + c_1 X2_{t-1} + D_1' Z_{t-1} + \upsilon_{it} \quad (2.8)$$

and

$$Slope_t = a_2 + b_2 TURN_{t-1} + c_2 X2_{t-1} + D_2' Z_{t-1} + \upsilon_{it} \quad (2.9)$$

The overconfidence hypothesis posits that any increase in $TURN_{t-1}$or $X2_{t-1}$ would have a positive effect on the Intercept (i.e., $b_1 > 0$, $c_1 > 0$), whereas any increase in TURNt-1 or X2t-1 would have a negative effect on the Slope (i.e., $b_2 < 0$, $c_2 < 0$).

Table 1 presents the descriptive statistics of the original variables. This study includes a total of 240,364 monthly observations for the period from January 2008 to December 2023. RET is calculated as the monthly stock returns minus the risk-free interest rate. The systematic risk BETA is between 0.53 and 1.30. The number of listed firms available for analysis is 987 in 2008 and 1,569 in 2023.

# 3 | Empirical results

## 3.1 Empirical model for validating overconfidence

Table 1 Descriptive statistics of the original variables

| Variables | Obs. | Mean | Std_Dev | Min | Max. |
|---|---|---|---|---|---|
| RET | 240,364 | 0.4280 | 11.59 | -123.27 | 127.60 |
| BETA | 240,364 | 0.8743 | 0.22 | 0.53 | 1.30 |
| LnME | 240,364 | 15.1215 | 1.29 | 13.07 | 17.77 |
| LnBTM | 240,364 | -0.3436 | 0.54 | -1.43 | 0.53 |
| OP | 240,364 | 0.0174 | 0.04 | -0.07 | 0.10 |
| INV | 240,364 | 4.9117 | 13.83 | -18.34 | 38.64 |
| $RET^{MOM}$ | 240,364 | 3.1716 | 35.20 | -52.44 | 89.48 |
| $RET^{STREV}$ | 240,364 | 0.4152 | 8.94 | -17.06 | 19.72 |

### 3.2 Empirical results of Fama-MacBeth regression

Table 2 presents the Fama-MacBeth regression coefficients obtained at the firm level in Taiwan. In all four sub-regression models, the intercept (constant) coefficients are positive (i.e., 1.10, 0.76, 2.34, and 2.44), indicating that stock investments yield returns that are above the market average in Taiwan. By contrast, the slope coefficients are all negative (i.e., -0.79, -0.74, -0.55, and -0.66). Regardless of model specifications, these negative slope coefficients indicates a downward-sloping inverted SML does exist in the Taiwan stock market. However, the results of t tests conducted using the OLS and Newey-West estimation methods for the slope coefficients are nonsignificant in all sub-regression models, suggesting a relatively flattened downward-sloping SML curve. In addition, the implied value of the SML slope coefficient in the Taiwan stock market ranges from -0.79 to -0.55, which lies between that of the US stock market (slope coefficient = 0.10; Frazzini & Pedersen, 2014) and that of the Chinese stock market (slope coefficient = -2.68; Han *et al.*, 2020). To determine whether this phenomenon is a coincidence or a result of stock market maturity, further research is required to explore economic conditions, financial and trading regulatory constraints, proportions of sophisticated institutional investors in shareholding and trading volume, and individual active trading behaviors.

Table 2 Fama-MacBeth regression coefficients at the firm level in Taiwan from January 2008 to December 2023

| | Const. | Beta | LnME | LnBTM | OP | INV | $RET^{MOM}$ | $RET^{STREV}$ | Adj.$R^2$ | Firms | Periods |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Coef. | 1.10 | -0.79 | | | | | | | 0.030 | 1251.90 | 192 |
| OLS_t | 0.90 | -0.50 | | | | | | | | | |
| NW_t | 0.80 | -0.46 | | | | | | | | | |

Table 2 Fama-MacBeth regression coefficients at the firm level in Taiwan from January 2008 to December 2023 (continued)

| | Const. | Beta | LnME | LnBTM | OP | INV | $RET^{MOM}$ | $RET^{STREV}$ | Adj.$R^2$ | Firms | Periods |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (2) Coef. | 0.76 | -0.74 | 0.04 | 0.86 | | | | | 0.046 | 1251.90 | 192 |
| OLS_t | 0.22 | -0.43 | 0.16 | 1.34 | | | | | | | |
| NW_t | 0.18 | -0.46 | 0.14 | 1.11 | | | | | | | |
| (3) Coef. | 2.34 | -0.55 | -0.09 | 1.08 | 14.21 | -0.00 | | | 0.057 | 1251.90 | 192 |
| OLS_t | 0.68 | -0.32 | -0.35 | 1.68 | 1.75 | -0.12 | | | | | |
| NW_t | 0.62 | -0.36 | -0.34 | 1.36 | 1.42 | -0.13 | | | | | |
| (4) Coef. | 2.44 | -0.66 | -0.09 | 1.10 | 13.97 | -0.01 | 0.00 | -0.02 | 0.070 | 1251.90 | 192 |
| OLS_t | 0.69 | -0.40 | -0.36 | 1.71 | 1.70 | -0.18 | -0.05 | -0.62 | | | |
| NW_t | 0.63 | -0.42 | -0.35 | 1.39 | 1.40 | -0.19 | -0.03 | -0.50 | | | |

*Note*: OLS_t refers to the OLS *t* test, and NW_t refers to the Newey-West *t* test. SAS-AUTOREG was performed using Newey and West's (1994) bandwidth selection method (max. lag = 12).

## 3.3 Empirical results of the overconfidence regression model

In the second stage, monthly intercept and slope variables, derived from empirical estimates in (2.5), are used as the dependent variables. Table 3 presents the descriptive statistics of the intercept and slope variables, market turnover ratios, retail and institutional investor shareholding ratios, and controlled variables. All independent and controlled variables are standardized and measured at t - 1. The average shareholding ratios for QFII, SIT, SFD, and RETL are 33.63%, 1.36%, 0.17%, and 64.85%, respectively. Among all investors, retail investors have the highest shareholding ratio, followed by QFII, who are common in emerging stock markets. These results indicate that retail investors may play a key role in the Taiwan stock market.

Table 3 Descriptive statistics of intercept and slope variables, market turnover ratios, retail and institutional investor shareholding ratios, and controlled variables

| Variables | Obs. | Mean | Std_Dev | Min. | Max. |
|---|---|---|---|---|---|
| Intercept | 191 | 1.0897 | 4.90 | -15.00 | 14.21 |
| Slope | 191 | -0.6785 | 8.96 | -28.71 | 31.31 |
| TURN | 191 | 0.1501 | 3.64 | -1.68 | 48.35 |
| QFII | 191 | 33.6251 | 4.15 | 27.02 | 43.33 |
| SIT | 191 | 1.3638 | 0.54 | 0.58 | 2.87 |

Table 3 Descriptive statistics of intercept and slope variables, market turnover ratios, retail and institutional investor shareholding ratios, and controlled variables (continued)

| Variables | Obs. | Mean | Std_Dev | Min. | Max. |
|---|---|---|---|---|---|
| SFD | 191 | 0.1659 | 0.08 | 0.06 | 0.57 |
| INST | 191 | 35.1548 | 3.92 | 29.25 | 44.50 |
| RETL | 191 | 64.8452 | 3.93 | 55.49 | 70.68 |
| LnME | 191 | 15.1011 | 0.22 | 14.45 | 15.48 |
| LnBTM | 191 | -0.3313 | 0.18 | -0.61 | 0.15 |
| OP | 191 | 0.0172 | 0.01 | 0.00 | 0.05 |
| INV | 191 | 4.8076 | 3.12 | -1.91 | 11.28 |

Table 4 presents the Pearson correlation coefficients of the Intercept and Slope variables, market turnover ratios, and retail and institutional investor shareholding ratios. As posited by SML theory, the Intercept and Slope variables have a strong negative correlation, indicating that a decrease in the slope corresponds to an increase in the intercept, suggesting a lower risk premium is associated with a higher baseline market return. The market turnover ratio shows a significant positive correlation with the shareholding ratios of SIT, implying that higher turnover correlates with increased investment trust activity. The shareholding ratios of QFII display significant correlations with other investor types, such as SIT, SFD, INST, and RETL highlighting a complex interplay among these groups. These findings underscore the importance of considering investor heterogeneity in financial analyses to better understand market dynamics and investor behaviors. By acknowledging these intricate relationships, analysts can gain deeper insights into how different investor influence market outcomes.

Table 4 Pearson's correlation coefficients of intercept and slope variables, market turnover ratios, and retail and institutional investor shareholding ratios

| | Intercept | Slope | TURN | QFII | SIT | SFD | INST |
|---|---|---|---|---|---|---|---|
| Slope | -0.584 ** | | | | | | |
| *p*_val | 0.000 | | | | | | |
| TURN | 0.063 | -0.028 | | | | | |
| *p*_val | 0.386 | 0.698 | | | | | |
| QFII | -0.060 | 0.036 | 0.065 | | | | |
| *p*_val | 0.410 | 0.625 | 0.373 | | | | |

Table 4 Pearson's correlation coefficients of intercept and slope variables, market turnover ratios, and retail and institutional investor shareholding ratios (continued)

| | **Intercept** | **Slope** | **TURN** | **QFII** | **SIT** | **SFD** | **INST** |
|---|---|---|---|---|---|---|---|
| SIT | 0.059 | -0.022 | 0.304 ** | -0.423 ** | | | |
| *p*_val | 0.416 | 0.765 | 0.000 | 0.000 | | | |
| SFD | 0.023 | -0.104 | 0.086 | -0.451 ** | 0.384 ** | | |
| *p*_val | 0.757 | 0.153 | 0.236 | 0.000 | 0.000 | | |
| INST | -0.055 | 0.033 | 0.112 | 0.992 ** | -0.304 ** | -0.405 ** | |
| *p*_val | 0.451 | 0.654 | 0.124 | 0.000 | 0.000 | 0.000 | |
| RETL | 0.057 | -0.033 | -0.111 | -0.991 ** | 0.305 ** | 0.406 ** | -0.999 ** |
| *p*_val | 0.432 | 0.651 | 0.127 | 0.000 | 0.000 | 0.000 | 0.000 |

*Note:* $^{*}p < .05$; $^{**}p < .01$.

Table 5a presents the results of 13 Intercept regression models based on (2.6) and (2.8). All control variables(LnME、LnBTM、OP、INV) are not standardized. In the Intercept regression models, the regression coefficients of TURN are significantly positive in all turnover-related models, indicating a significant contribution of turnover ratio to the alpha coefficient. Each standard deviation increases in TURN results in a 0.06% to 0.10% increase in the Intercept variable. However, the regression coefficients of different investors (QFII, SIT, SFD, INST, RETL, INS_NBS, and INS_TR) are not statistically significant to the Intercept, indicating that excess returns and abnormal return rates are not affected by different investors. Notably, INS_NBS and INS_TR are used in models 12 and 13 to conduct robustness tests for the other institutional variables. The coefficient for Operational Performance (OP) is highly significant, indicating a strong negative impact on the interception of the SML. This suggests that higher operational performance leads to lowering the interceptive value, which in turn would tend to support traditional SML theory.

This study compares the effects of overconfidence among different types of investors and turnover ratios by using the Intercept equation s, and the results are presented in Table 5b. Linear hypothesis F tests reveal no significant differences between the investors and turnover ratios.

Table 5a Effects of turnover and investors on the intercept of the SML

| **Dep. Var = Intercept of SML** | | | | | | |
|---|---|---|---|---|---|---|
| **Eq.** | **1** | **2** | **3** | **4** | **5** | **6** |
| | **TURN** | **QFII** | **SIT** | **SFD** | **INST** | **RETL** |
| Const. | 130.68 * | 112.01 | 112.13 * | 88.27 | 130.51 | 125.33 |
| NW_t | 2.01 | 1.28 | 2.45 | 1.18 | 1.36 | 1.45 |

Table 5a Effects of turnover and investors on the intercept of the SML (continued)

| Dep. Var = Intercept of SML | | | | | | |
|---|---|---|---|---|---|---|
| **Eq.** | **1** | **2** | **3** | **4** | **5** | **6** |
| | **TURN** | **QFII** | **SIT** | **SFD** | **INST** | **RETL** |
| TURN | 0.09 ** | | | | | |
| NW_t | 4.89 | | | | | |
| QFII | | -0.11 | | | | |
| NW_t | | -0.28 | | | | |
| SIT | | | 0.41 | | | |
| NW_t | | | 1.96 | | | |
| SFD | | | | 0.33 | | |
| NW_t | | | | 0.61 | | |
| INST | | | | | 0.01 | |
| NW_t | | | | | 0.03 | |
| RETL | | | | | | 0.02 |
| NW_t | | | | | | 0.06 |
| LnME | -8.70 * | -7.44 | -7.44 * | -5.81 | -8.69 | -8.34 |
| NW_t | -1.98 | -1.25 | -2.39 | -1.14 | -1.33 | -1.42 |
| LnBTM | -15.50 * | -14.62 | -14.89 ** | -12.27 | -15.66 | -15.37 * |
| NW_t | -2.34 | -1.84 | -3.44 | -1.80 | -1.85 | -2.03 |
| OP | -189.44 ** | -187.47 ** | -186.66 ** | -194.26 ** | -189.02 ** | -188.58 ** |
| NW_t | -3.88 | -3.34 | -4.42 | -3.60 | -3.40 | -3.75 |
| INV | -0.01 | -0.04 | -0.08 | -0.03 | -0.02 | -0.02 |
| NW_t | -0.06 | -0.17 | -0.34 | -0.15 | -0.10 | -0.11 |
| Adj.$R^2$ | 0.107 | 0.103 | 0.109 | 0.106 | 0.102 | 0.102 |
| Obs. | 191 | 191 | 191 | 191 | 191 | 191 |

*Note:* $^{*}p < .05$; $^{**}p < .01$. NW_t refers to the Newey-West t test.

Table 5a Effects of turnover and investors on the intercept of the SML

| Dep. Var = Intercept of SML | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Eq.** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| | **QFII** | **SIT** | **SFD** | **INST** | **RETL** | **INS_NBS** | **INS_TR** |
| Const. | 113.81 | 116.84 * | 95.32 | 126.67 | 121.63 | 138.80 * | 165.63 * |
| NW_t | 1.37 | 2.47 | 1.28 | 1.39 | 1.51 | 2.36 | 2.33 |
| $TURN_{t-1}$ | 0.09 ** | 0.06 ** | 0.08 ** | 0.09 ** | 0.09 ** | 0.10 ** | 0.09 ** |

Table 5a Effects of turnover and investors on the intercept of the SML (continued)

| **Dep. Var = Intercept of SML** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Eq.** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| | **QFII** | **SIT** | **SFD** | **INST** | **RETL** | **INS_NBS** | **INS_TR** |
| NW_t | 4.27 | 2.65 | 4.65 | 4.28 | 4.54 | 4.61 | 3.77 |
| QFII | -0.12 | | | | | | |
| NW_t | -0.30 | | | | | | |
| SIT | | 0.33 | | | | | |
| NW_t | | 1.34 | | | | | |
| SFD | | | 0.29 | | | | |
| NW_t | | | 0.53 | | | | |
| INST | | | | -0.03 | | | |
| NW_t | | | | -0.06 | | | |
| RETL | | | | | 0.06 | | |
| NW_t | | | | | 0.18 | | |
| INS_NBS | | | | | | 0.17 | |
| NW_t | | | | | | 0.62 | |
| INS_TR | | | | | | | 0.25 |
| NW_t | | | | | | | 0.76 |
| LnME | -7.56 | -7.76 * | -6.29 | -8.43 | -8.09 | -9.25 * | -11.07 * |
| NW_t | -1.35 | -2.42 | -1.24 | -1.37 | -1.49 | -2.32 | -2.30 |
| LnBTM | -14.56 | -14.99 ** | -12.63 | -15.27 | -14.99 * | -16.05 ** | -17.93 * |
| NW_t | -1.94 | -3.37 | -1.94 | -1.89 | -2.15 | -2.77 | -2.48 |
| OP | -188.04 ** | -187.49 ** | -194.15 ** | -189.11 ** | -188.68 ** | -190.47 ** | -189.55 ** |
| NW_t | -3.56 | -4.44 | -3.77 | -3.55 | -3.94 | -4.30 | -3.63 |
| INV | -0.03 | -0.06 | -0.02 | -0.01 | -0.02 | 0.00 | -0.01 |
| NW_t | -0.13 | -0.25 | -0.10 | -0.07 | -0.09 | -0.02 | -0.03 |
| Adj.R2 | 0.102 | 0.105 | 0.104 | 0.102 | 0.102 | 0.103 | 0.103 |
| Obs. | 191 | 191 | 191 | 191 | 191 | 191 | 191 |

*Note:* $^{*}p < .05$; $^{**}p < .01$

Table 5b Differential parameter tests of the intercept equations

| **Equation** | **Item** | **Inv. Coeff.** | **Turn. Coeff.** | **Diff.** | **F test** | ***p* value** |
|---|---|---|---|---|---|---|
| Inter07 | QFII | -0.1159 | 0.0900 | -0.206 | 0.27 | 0.6014 |
| Inter 08 | SIT | 0.3340 | 0.0605 | 0.274 | 1.03 | 0.3114 |

Table 5b Differential parameter tests of the intercept equations (continued)

| Equation | Item | Inv. Coeff. | Turn. Coeff. | Diff. | F test | *p* value |
|---|---|---|---|---|---|---|
| Inter 09 | SFD | 0.2871 | 0.0823 | 0.205 | 0.14 | 0.7096 |
| Inter 10 | INST | -0.0276 | 0.0902 | -0.118 | 0.08 | 0.7845 |
| Inter 11 | RETL | 0.0625 | 0.0907 | -0.028 | 0.01 | 0.9349 |
| Inter 12 | INS_NBS | 0.1714 | 0.0967 | 0.075 | 0.08 | 0.7768 |
| Inter 13 | INS_TR | 0.2454 | 0.0851 | 0.160 | 0.23 | 0.6321 |

Table 6a presents the results of 13 Slope regression models based on (2.7) and (2.9). In the slope regression models, the regression coefficients of TURN are significantly negative in models 7, 10, and 11, indicating a significant contribution of turnover ratio to the slope variable. Each standard deviation increases in TURN results in a -0.07 to -0.06 decrease in the slope variable.

Each increase in the shareholding ratios of QFII and INST in models 2, 5, 7, and 10 results in a positive swift of the slope parameter, and this supports SML theory. By contrast, each increase in the shareholding ratios of retail investors in models 6 and 11 results in a negative rotation of the swift parameter, which increases the negativity of the SML curve and supports the overconfidence hypothesis. In models 6 and 11, the slope regression coefficients of RETL range between -1.05 and -1.01. These results indicate that institutional investors are supportive factors for SML theory, whereas turnover ratios and retail investors lead to overconfidence behaviors. Notably, INS_NBS and INS_TR are used in models 12 and 13 to conduct robust tests for the other institutional variables; they do not have a significant effect on the slope variable.

Table 6b presents a comparison of the effects of different types of investors and turnover ratios, which is conducted using the slope equations. Linear hypothesis F tests reveal a significantly negative difference between retail investors (RETL) and market turnover ratio (TURN), indicating that retail investors are more influential than the turnover ratio in overconfidence behaviors. Because all independent variables are standardized, a direct comparison of magnitude is conducted. The empirical results reveal that the effects of RETL are 14 to 17 times greater than those of TURN. However, a significantly positive difference in TURN is observed between QFII and INST. These results indicate that the shareholding behaviors of the institutional investors tend to steadily support the positivity of the SML.

Table 6a Effects of turnover and investors on the slope of the SML

| **Dep. Var = Slope of SML** | | | | | | |
|---|---|---|---|---|---|---|
| **Eq.** | **1 TURN** | **2 QFII** | **3 SIT** | **4 SFD** | **5 INST** | **6 RETL** |
| Const. | -170.56 * | -35.82 | -172.18 ** | -100.41 | -21.25 | -21.65 |
| NW_t | -2.23 | -0.90 | -2.64 | -1.10 | -0.30 | -0.26 |

Table 6a Effects of turnover and investors on the slope of the SML (continued)

| **Dep. Var = Slope of SML** | | | | | | |
|---|---|---|---|---|---|---|
| **Eq.** | **1 TURN** | **2 QFII** | **3 SIT** | **4 SFD** | **5 INST** | **6 RETL** |
| TURN | -0.06 | | | | | |
| NW_t | -1.60 | | | | | |
| QFII | | 0.92 ** | | | | |
| NW_t | | 6.02 | | | | |
| SIT | | | 0.08 | | | |
| NW_t | | | 0.31 | | | |
| SFD | | | | -0.56 | | |
| NW_t | | | | -1.46 | | |
| INST | | | | | 1.01 ** | |
| NW_t | | | | | 3.25 | |
| RETL | | | | | | -1.01 ** |
| NW_t | | | | | | -3.27 |
| LnME | 11.71 * | 2.60 | 11.82 ** | 6.93 | 1.62 | 1.65 |
| NW_t | 2.24 | 0.96 | 2.66 | 1.11 | 0.33 | 0.29 |
| LnBTM | 18.23 * | 10.82 ** | 18.39 * | 12.66 | 9.98 | 10.02 |
| NW_t | 2.38 | 3.69 | 2.53 | 1.47 | 1.71 | 1.56 |
| OP | 49.87 | 38.37 ** | 49.89 | 58.74 | 36.89 | 37.02 |
| NW_t | 1.23 | 2.88 | 1.48 | 1.96 | 1.42 | 1.28 |
| INV | -0.37 | -0.25 ** | -0.38 * | -0.35 * | -0.25 | -0.25 |
| NW_t | -1.85 | -3.17 | -2.03 | -2.05 | -1.90 | -1.71 |
| Adj.$R^2$ | 0.012 | 0.015 | 0.011 | 0.014 | 0.016 | 0.016 |
| Obs. | 191 | 191 | 191 | 191 | 191 | 191 |

*Note:* $^{*}p < .05$; $^{**}p < .01$. NW_t refers to the Newey-West t statistic.

Table 6a Effects of turnover and investors on the slope of the SML

| **Dep. Var = Slope of SML** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Eq.** | **7 QFII** | **8 SIT** | **9 SFD** | **10 INST** | **11 RETL** | **12 INS_NBS** | **13 INS_TR** |
| Const. | -37.03 | -178.06 * | -104.31 | -18.09 | -18.63 | -161.56 * | -129.67 |
| NW_t | -0.50 | -2.50 | -1.05 | -1.11 | -0.33 | -2.31 | -1.26 |
| $TURN_{t-1}$ | -0.06 ** | -0.08 | -0.05 | -0.07 ** | -0.07 ** | -0.05 | -0.07 |
| NW_t | -3.73 | -1.65 | -1.08 | -19.80 | -5.48 | -1.56 | -1.82 |

Table 6a Effects of turnover and investors on the slope of the SML (continued)

| **Dep. Var = Slope of SML** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Eq.** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| | **QFII** | **SIT** | **SFD** | **INST** | **RETL** | **INS_NBS** | **INS_TR** |
| QFII | 0.92 ** | | | | | | |
| NW_t | 3.39 | | | | | | |
| SIT | | 0.18 | | | | | |
| NW_t | | 0.57 | | | | | |
| SFD | | | -0.54 | | | | |
| NW_t | | | -1.36 | | | | |
| INST | | | | 1.05 ** | | | |
| NW_t | | | | 15.52 | | | |
| RETL | | | | | -1.05 ** | | |
| NW_t | | | | | -5.02 | | |
| INS_NBS | | | | | | 0.19 | |
| NW_t | | | | | | 0.55 | |
| INS_TR | | | | | | | 0.29 |
| NW_t | | | | | | | 0.54 |
| LnME | 2.68 | 12.22 * | 7.19 | 1.40 | 1.44 | 11.10 | 8.94 |
| NW_t | 0.53 | 2.51 | 1.06 | 1.27 | 0.38 | 2.33 * | 1.28 |
| LnBTM | 0.77 * | 18.51 * | 12.87 | 9.66 ** | 9.71 * | 17.62 | 15.39 |
| NW_t | 2.04 | 2.41 | 1.44 | 7.64 | 2.31 | 2.51 * | 1.86 |
| OP | 38.75 | 50.93 | 58.68 | 36.96 ** | 37.11 | 48.73 | 49.75 |
| NW_t | 1.63 | 1.30 | 1.70 | 6.36 | 1.85 | 1.36 | 1.24 |
| INV | -0.26 | -0.40 | -0.36 | -0.25 ** | -0.25 * | -0.36 | -0.37 |
| NW_t | -1.78 | -1.97 | -1.82 | -7.76 | -2.16 | -1.84 | -1.78 |
| Adj.R2 | 0.0107 | 0.0066 | 0.0089 | 0.0118 | 0.0118 | 0.007 | 0.007 |
| Obs. | 191 | 191 | 191 | 191 | 191 | 191 | 191 |

*Note:* $^{*}p < .05$; $^{**}p < .01$

Table 6b Differential parameter tests of the slope equations

| Equation | Item | Inv. Coeff. | Turn. Coeff. | Diff. | F test | *p* value |
|---|---|---|---|---|---|---|
| Slope07 | QFII | 0.9175 | -0.0607 | 0.978 | 13.53 | 0.0003 ** |
| Slope08 | SIT | 0.1807 | -0.0755 | 0.256 | 0.53 | 0.4668 |
| Slope09 | SFD | -0.5379 | -0.0455 | -0.492 | 1.36 | 0.2448 |

Table 6b Differential parameter tests of the slope equations (continued)

| Equation | Item | Inv. Coeff. | Turn. Coeff. | Diff. | F test | *p* value | |
|---|---|---|---|---|---|---|---|
| Slope10 | INST | 1.0482 | -0.0743 | 1.123 | 281.35 | 0.0001 | ** |
| Slope11 | RETL | -1.0478 | -0.0740 | -0.974 | 21.38 | 0.0001 | ** |
| Inter12 | INS_NBS | 0.1903 | -0.0520 | 0.242 | 0.50 | 0.4803 | |
| Inter13 | INS_TR | 0.2872 | -0.0653 | 0.353 | 0.44 | 0.5091 | |

## 4 | Conclusions

This study investigates the curvature of the SML in the Taiwan stock market and validates the overconfidence hypothesis by using market turnover ratios, retail investors, and three types of institutional investors. The results of Fama-MacBeth regression reveal a flattened negative SML slope, with the slope coefficients ranging between -0.79 and -0.55, which are between those of the well-developed US stock market (0.10) and the emerging Chinese stock market (-2.68).

Both the intercept and slope overconfidence hypotheses are statistically validated. Market turnover ratio (TURN) has a positive effect on the Intercept variable, suggesting the presence of excess abnormal returns in the Taiwan stock market as a result because of overconfidence behaviors. By contrast, market turnover ratio (TURN) and retail investors (RETL) have a negative effect on the Slope variable, suggesting that any increase in either TURN or RETL would make low-beta portfolios more profitable than high-beta portfolios, resulting in a negative SML. In addition, the shareholding ratios of retail investors have a stronger effect than that of the market turnover ratios. Nevertheless, QFII and total institutional investors (INST) tend to support a positive traditional SML in the Taiwan stock market.

Market turnover ratios and retail investor shareholding ratios tend to validate the overconfidence hypothesis in emerging stock markets, such as that of Taiwan. A negative SML curve may exist in any emerging stock market because of extensive trading activity by unsophisticated (retail) investors, which may in turn lead to major changes in market turnover ratio and stock market volatility. Therefore, low-beta anomalies may be more common in emerging stock markets than in developed stock markets. Furthermore, examining this phenomenon in Taiwan is significant due to its unique market structure, comprising a high proportion of retail investors and foreign institutional investors (QFII). This diversity provides a unique setting to explore the impact of investor heterogeneity on market performance. Understanding these dynamics in Taiwan can offer new insights into global market behavior and investor psychology.

Several factors may be responsible for the changes observed in the curvature of the SML in a stock market. These factors include stock market maturity, economic uncertainty, financial and trading regulatory constraints, market volatility, market turnover ratio, sophisticated or retail investor shareholding ratio, percentage of retail investor trading volume, and herding behavior. Further research on overconfidence is warranted to help retail and institutional investors make

more appropriate investment decisions and create a more conducive stock market regulatory environment.

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# 散戶或機構投資者的持股比例和市場週轉率是否是臺灣股票市場中證券市場線負斜率的決定因素？

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**摘要**

本研究探討證券市場線（SML）的曲率，並檢視散戶或機構投資者是否在臺灣股票市場中扮演形塑 SML 的關鍵角色。經採用 Fama-MacBeth 回歸分析的實證結果顯示，臺灣股票市場的 SML 斜率為負。另外，亦檢驗市場週轉率、散戶投資者和三種類型機構投資者的過度自信假設。結果顯示，相比於市場週轉率，非精明的投資者（散戶）投資者在形塑 SML 的負斜率方面更具影響力。相反的，機構投資者則傾向於支持臺灣股票市場正向傳統的 SML。

**關鍵字:**

證券市場線、投資人過度自信、散戶投資人、機構投資人、股市週轉率