

# 本邦株価の市場予想と市場価格変動の計量分析

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# 1. Introduction

- ✓ Forecasts of the stock market are presented frequently from various sources and are sometimes reported as factors influencing stock price movements.
- ✓ In U.S., Chen et al. (2014) shows that opinions expressed on social media can predict stock returns.  
However, obtaining social media data is challenging in Japan due to cost constraints.
- ✓ We use readily available **analyst forecast data** in Japan to conduct a quantitative analysis of **how market expectations relate to actual stock price movements**.

## 2. Research method

- ✓ The relationship between  
return of Nikkei 225 forecasts\* (explanatory variable, **1-week lag**)  
return of actual Nikkei 225 index (dependent variable)  
is quantitatively measured using **quantile regression** following  
Ando, Greenwood-Nimmo, and Shin (2022), to examine how the degree of  
stock price changes impacts the relationship
- ✓ Following Senoguchi et al. (2020), other explanatory variables (1-week lag)  
include return (R.) or difference (D.) of  
Nikkei 225 index, S&P 500 Index, USD/JPY,  
Nikkei Volatility Index, domestic 10-year bond yield,  
the yield spread between domestic 30-year and 5-year bonds.

\*FactSet / Bloomberg calculation based on the aggregation of individual stock forecast values

# Quantile regression

- ✓ For a given quantile  $\tau$ , we solve;

$$\begin{aligned} & \hat{\boldsymbol{\beta}}(\tau) \\ &= \arg \min_{\boldsymbol{\beta}} \sum_{t=1}^N \left\{ \tau \cdot 1_{\{Y_t \geq \boldsymbol{\beta}^\top \mathbf{X}_{t-1}\}} |Y_t - \boldsymbol{\beta}^\top \mathbf{X}_{t-1}| + (1 - \tau) \cdot 1_{\{Y_t < \boldsymbol{\beta}^\top \mathbf{X}_{t-1}\}} |Y_t - \boldsymbol{\beta}^\top \mathbf{X}_{t-1}| \right\}. \end{aligned}$$

- ✓ Estimated  $\tau$ -quantile weekly return of Nikkei 225 index is given by,

$$\hat{Q}_\tau(Y_t | \mathbf{X}_{t-1}) = \sum_{k=0}^p \hat{\beta}_k(\tau) X_{t-1,k},$$

where  $X_{t-1,0} = 1$  to include the intercept term in the explanatory variables and  $\tau \in \{0.1, 0.2, \dots, 0.9\}$ .

# 3.1 Result 1: NKY vs FSE

- ✓ The coefficients for R.NKY are negative across all quantiles, while the coefficients for R.SPX and R.JPY are consistently positive.

Coefficients (t-values) from Quantile Regression

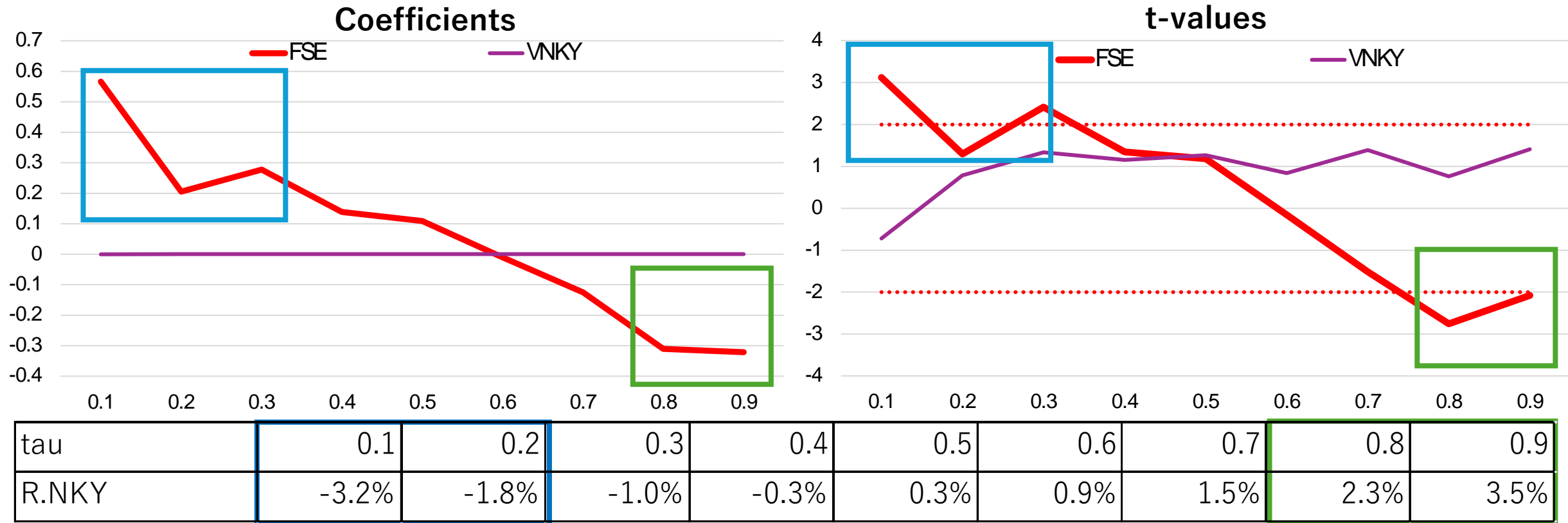
tau	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
R.NKY	-0.16(-2.00)	-0.06(-1.03)	-0.04(-1.01)	-0.07(-1.51)	-0.08(-1.73)	-0.11(-2.64)	-0.16(-3.74)	-0.15(-2.85)	-0.15(-2.49)
R.SPX	0.29(3.47)	0.21(3.06)	0.2(3.84)	0.19(3.56)	0.16(3.26)	0.09(1.99)	0.13(2.48)	0.07(1.3)	0.03(0.54)
R.JPY	0.2(1.57)	0.31(2.93)	0.27(3.36)	0.24(3.05)	0.27(3.38)	0.24(3.49)	0.29(3.85)	0.22(2.69)	0.13(1.3)
D.VNKY	-0.0003(-0.71)	0.0003(0.78)	0.0004(1.33)	0.0004(1.15)	0.0003(1.26)	0.0002(0.83)	0.0005(1.39)	0.0002(0.76)	0.0005(1.4)
D.GJGB	0.05(1.45)	0.01(0.61)	0.01(0.82)	0.002(0.11)	0(0.03)	-0.001(-0.07)	-0.002(-0.12)	-0.03(-1.47)	-0.01(-0.4)
D.SPREAD	-0.03(-1.17)	-0.01(-0.52)	-0.03(-1.84)	-0.01(-1.1)	-0.02(-1.2)	-0.02(-1.6)	-0.03(-3.5)	-0.0004(-0.02)	0.03(1.67)
R.FSE	0.56(3.12)	0.2(1.29)	0.27(2.41)	0.13(1.34)	0.1(1.18)	-0.01(-0.15)	-0.12(-1.51)	-0.31(-2.75)	-0.32(-2.07)

NKY: Nikkei 225 Index, SPX: U.S. S&P 500 Index, JPY: USD/JPY Exchange Rate, VNKY: Nikkei Volatility Index, GJGB: Domestic 10-Year Bond Yield, SPREAD: Domestic 30–5 Year Bond Yield Spread, FSE: FactSet Nikkei 225 Forecast

The prefix "R." indicates weekly rate of change, and "D." indicates weekly difference.

Significant quantiles at the 5% level are highlighted.

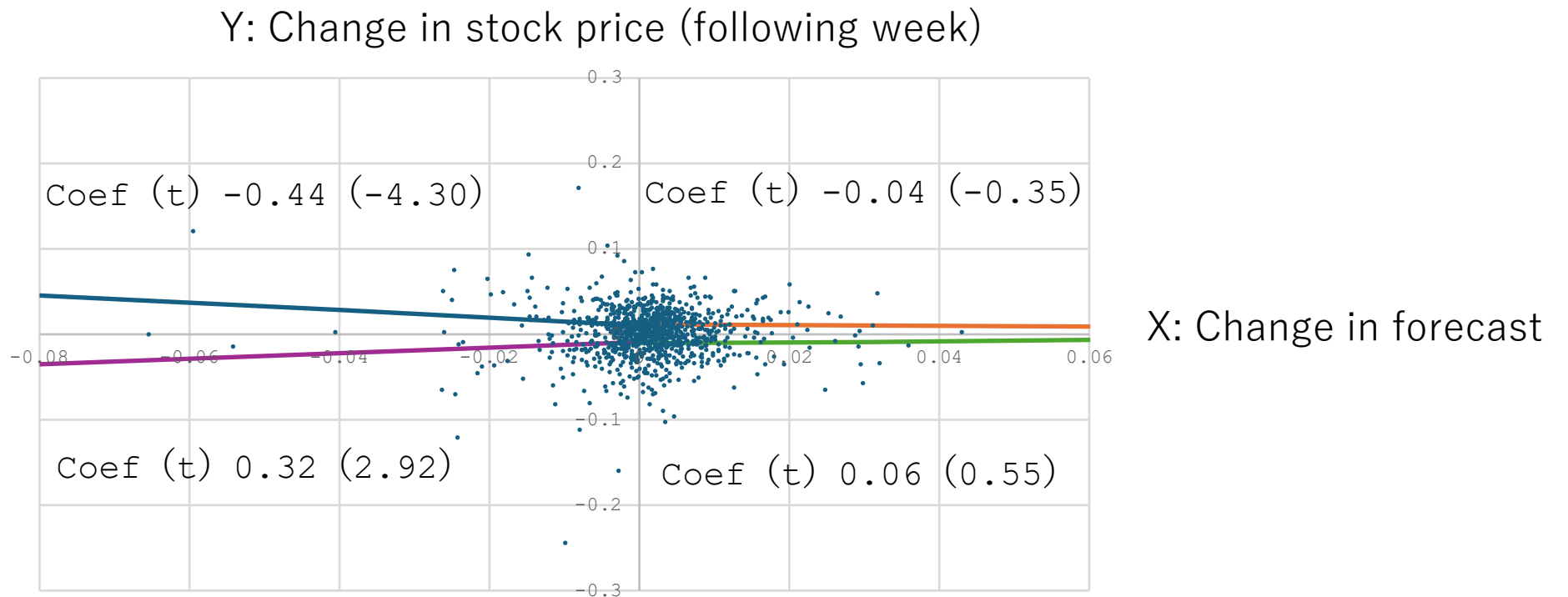
### 3.1 Result 1: NKY vs FSE (cont.)



- ✓ The coefficient for R.FSE is **positive at lower quantiles** where the Nikkei 225 decreases, and **negative at higher quantiles** where it increases, both significant at the 5% level.
- ✓ This suggests that forecasts are revised downward before large stock price movements, **potentially reflecting increased uncertainty**.
- ✓ In contrast, the relationship between NKY and VNKY is limited.

## 3.2 The relationship with upward/downward revisions

- ✓ To examine whether forecast upward revisions and downward revisions have different impacts on stock prices, OLS is conducted within each quadrant.
- ✓ The results indicate that returns of NKY and FSE are little correlated with upward revisions (Quadrants I and IV), **significantly correlated with downward revisions** (Quadrants II and III).



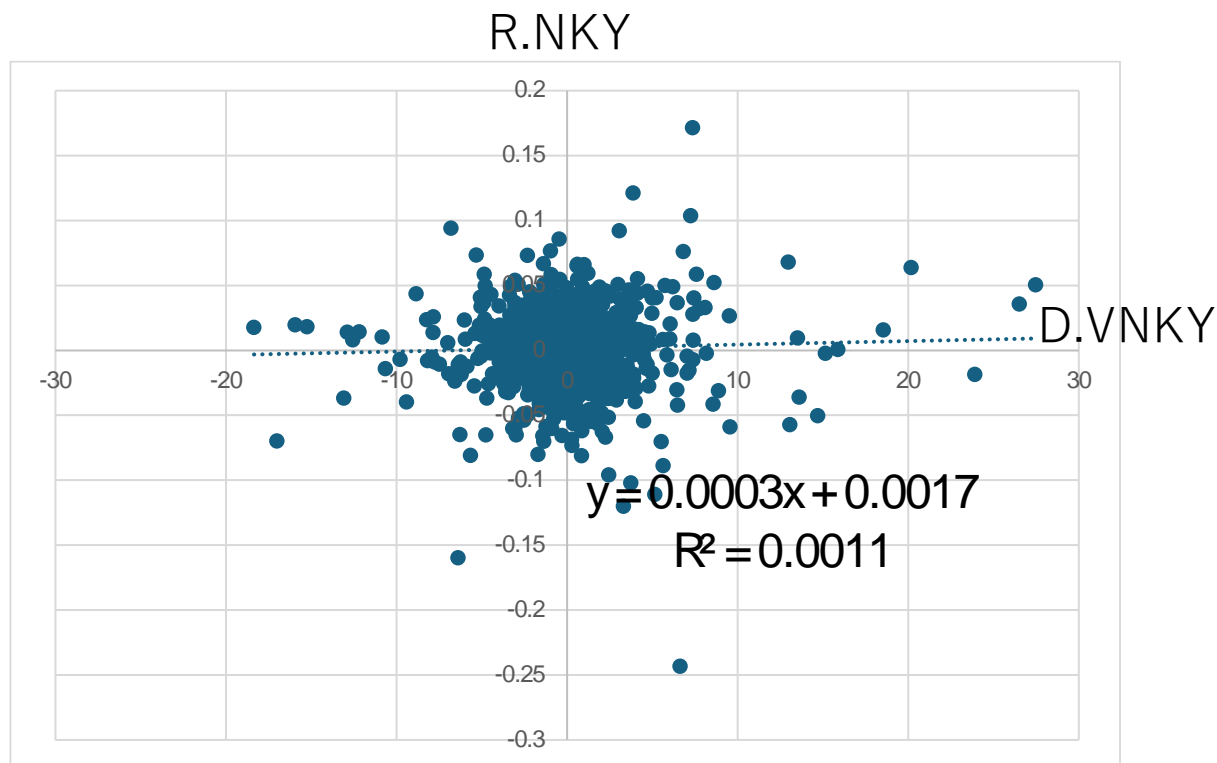
Coef: Coefficient, t: t-value

### 3.3 The relationship between VNKY and NKY

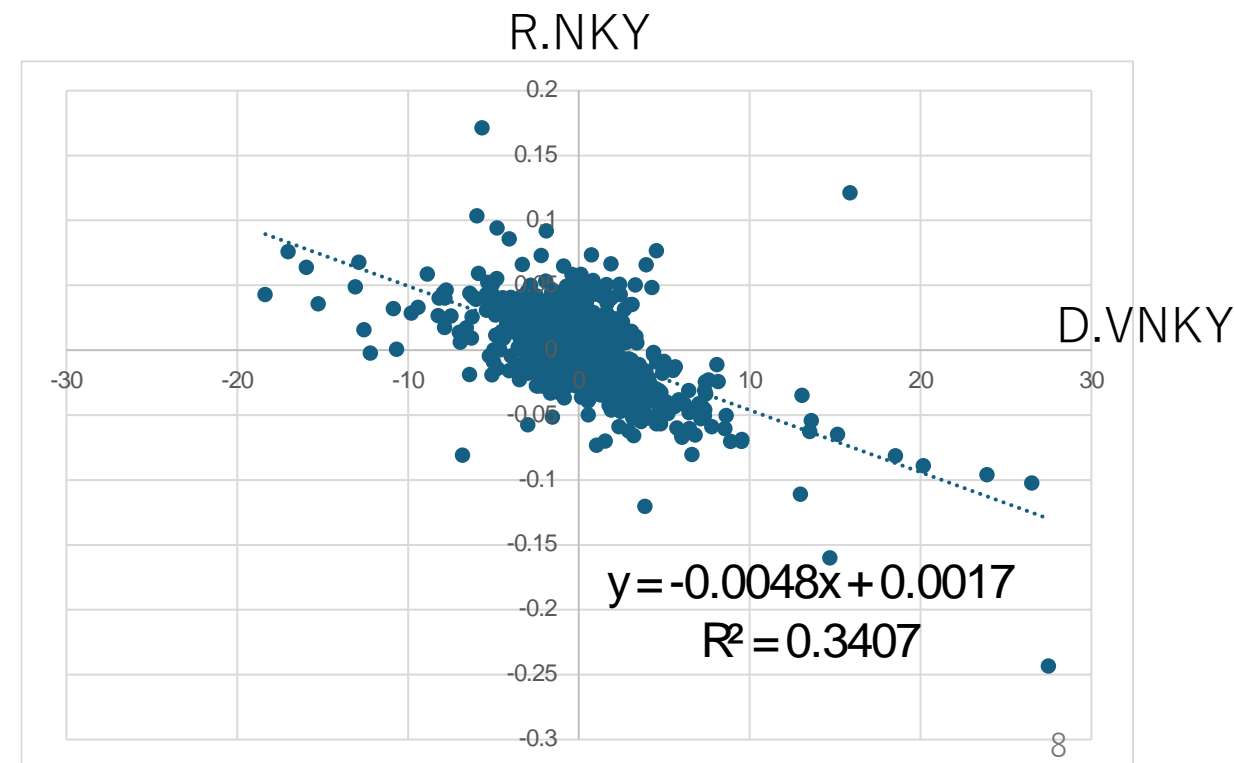
The relationship between

D.VNKY (weekly change in the Nikkei Volatility Index) and  
R.NKY (weekly return in the Nikkei 225 index).

1-week lag



no lag





### 3.3 What is FSE related to?

- ✓ The relationships between R.FSE (as the dependent variable) and other variables are as follows;
  - **highly auto-correlated**,
  - though their impacts are minor compared to the autocorrelation, positive with R.NKY and D.GJGB, negative with D.SPREAD, **not significant with D.VNKY** overall.

Coefficients (t-values) from Quantile Regression

tau	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
R.NKY	0.015(0.96)	0.03(3.21)	0.031(3.57)	0.032(4.68)	0.037(5.42)	0.036(4.45)	0.038(4.33)	0.05(5.47)	0.05(2.67)
D.VNKY	0.00008(0.73)	0.00013(1.92)	0.00011(1.93)	0.00008(1.66)	0.00011(2.42)	0.00007(1.14)	0.00004(0.76)	0.00017(3.63)	0.00018(1.5)
R.SPX	0.012(0.63)	0.017(1.56)	0.018(1.93)	0.014(1.71)	0.015(2.03)	0.018(2.08)	0.006(0.75)	0.017(2.51)	-0.002(-0.14)
R.JPY	0.057(2.14)	0.019(1.22)	0.006(0.43)	0.003(0.23)	-0.006(-0.59)	-0.015(-1.1)	-0.022(-1.71)	-0.023(-1.6)	0.011(0.41)
D.GJGB	0.001(0.08)	0.01(2.18)	0.008(2.11)	0.01(3.02)	0.013(3.9)	0.015(3.94)	0.015(3.85)	0.012(3.24)	0.027(3.22)
D.SPREAD	-0.016(-2.29)	-0.011(-3.41)	-0.009(-3.17)	-0.009(-3.99)	-0.005(-2.36)	-0.005(-1.65)	-0.005(-1.65)	-0.008(-2.24)	-0.017(-2.38)
R.FSE	0.684(16.93)	0.671(32.94)	0.638(31.37)	0.608(48.52)	0.602(40.22)	0.593(27.75)	0.594(43.24)	0.611(27.67)	0.604(17.81)

Significant quantiles at the 5% level are highlighted.

### 3.4 What is VNKY (indicating uncertainty) related to?

- ✓ The relationships between D.VNKY (as the dependent variable) and other variables are as follows;
  - negatively auto-correlated for all quantiles,
  - the relationship with R.FSE shifts from positive at lower quantiles to negative at higher quantiles,
- ✓ Similar to previous findings, the characteristics of D.VNKY and R.FSE **differ apparently**.

Coefficients (t-values) from Quantile Regression

tau	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
R.NKY	2.75(0.35)	5.13(1.45)	10.46(2.91)	4.01(1.38)	4.79(1.28)	4.5(1.74)	2.75(0.57)	5.76(1.23)	-5.56(-0.57)
D.VNKY	-0.32(-5.43)	-0.33(-8.27)	-0.26(-10.16)	-0.24(-11.09)	-0.22(-7.4)	-0.22(-6.7)	-0.22(-10.3)	-0.17(-6.65)	-0.13(-1.76)
R.SPX	-4.59(-0.54)	-13.34(-2.2)	-13.95(-3.78)	-10.53(-2.66)	-15.68(-3.8)	-24.47(-7.76)	-33.23(-6.54)	-36.82(-6.94)	-42.93(-4.36)
R.JPY	8.65(0.67)	2.07(0.3)	-1.8(-0.33)	-1.79(-0.34)	-8.15(-1.8)	-11.81(-1.81)	-18.16(-2.26)	-24.44(-3.1)	-21.04(-1.9)
D.GJGB	1.17(0.31)	-2.08(-0.86)	0.5(0.29)	1.64(0.94)	1.05(0.59)	0.83(0.37)	2.92(1.4)	0.39(0.17)	-4.57(-0.84)
D.SPREAD	-0.5(-0.17)	-2.28(-1.64)	-0.66(-0.49)	-0.99(-0.7)	-1.87(-1.21)	-2.26(-1.31)	-2.02(-1.77)	1.73(0.98)	4.14(1.06)
R.FSE	101.67(5.81)	57.12(8.86)	45.18(5.76)	33.51(7.47)	22.05(3.52)	10.32(1.23)	-2.79(-0.24)	-16.46(-1.55)	-29.83(-1.77)

Quantiles significant at the 5% level are highlighted.

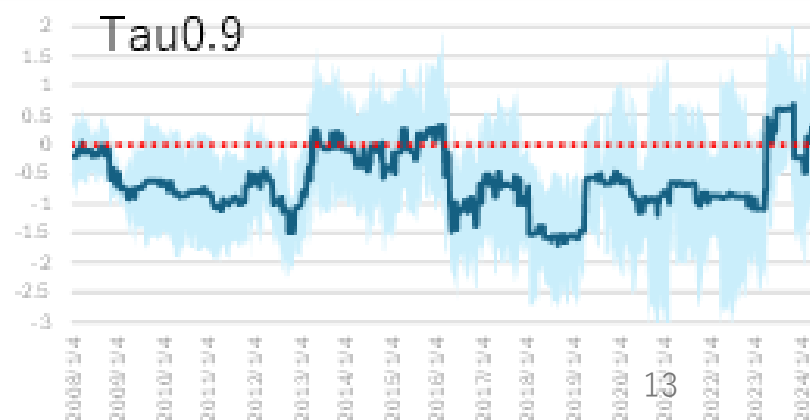
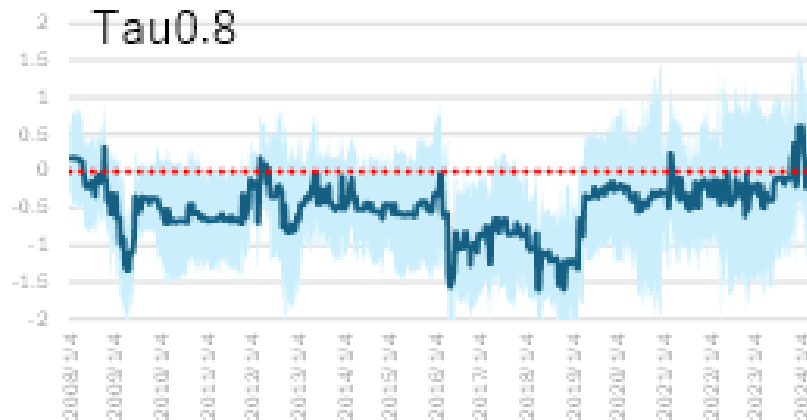
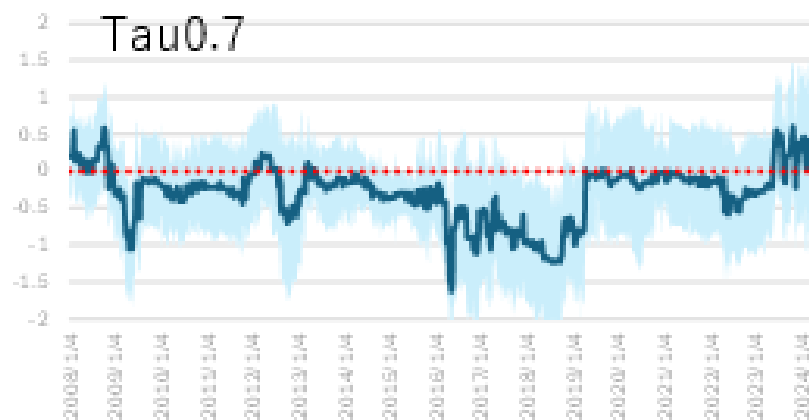
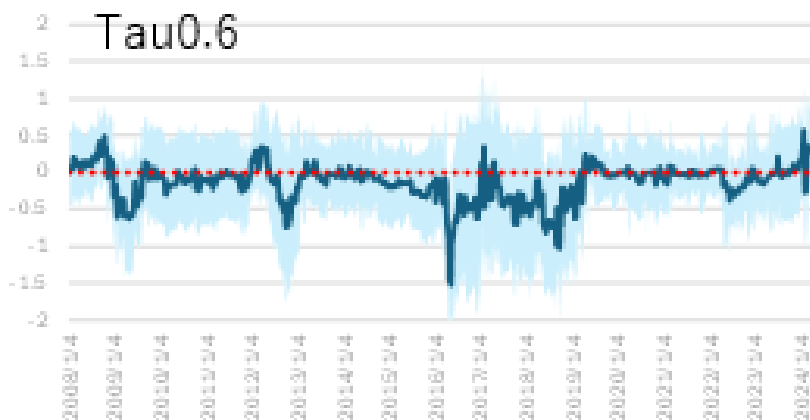
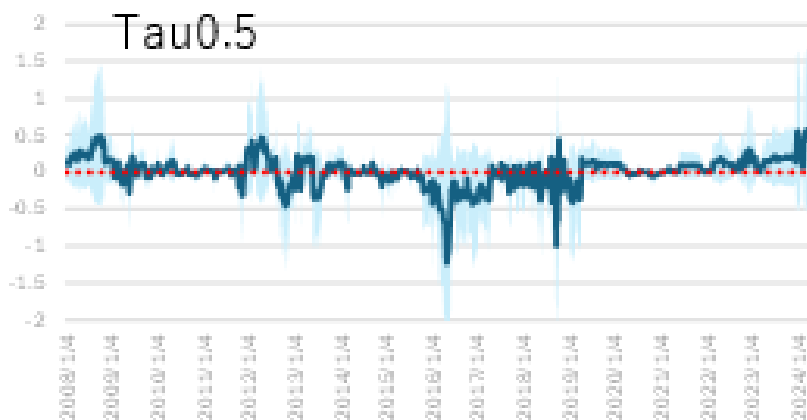
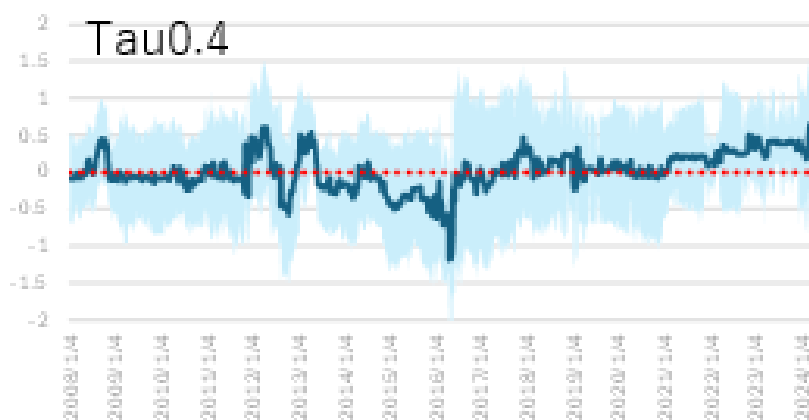
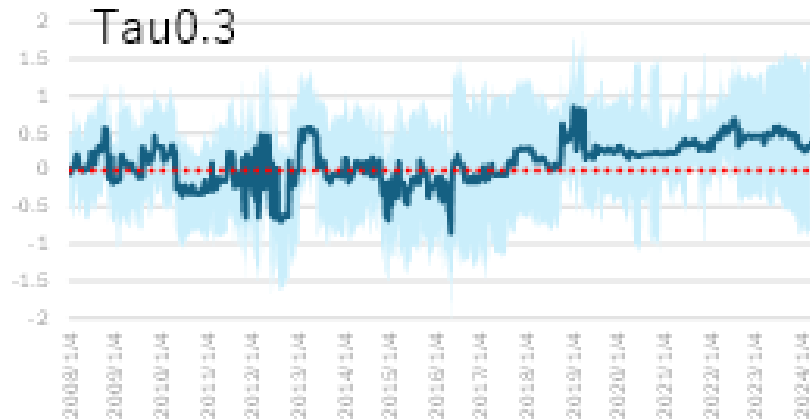
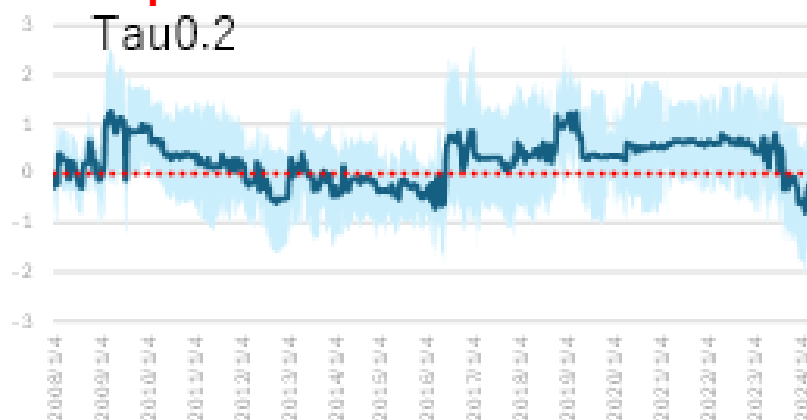
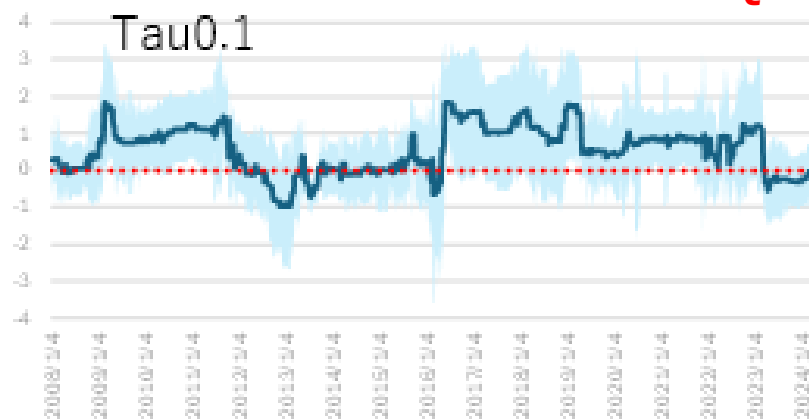
## 3.5 Summary of results

- ✓ Before huge changes in stock prices, forecasts tend to be revised downward in advance.
  - Direction/size of forecast change can be regarded as **a proxy for market uncertainty.**
- ✓ Forecast exhibits high auto-correlation and show a certain degree of trend.
  - weak correlations with other variables, indicating **independent movement.**
- ✓ **The characteristics of volatility and market forecasts differ,**
  - The volatility index is an estimate over the next month,
  - FSE is for an index value in 6 to 12 months future,  
which are interpreted as **reflecting different aspects of market uncertainty.**

## 4. Time series analysis

- ✓ *Has the relationship between forecasts and stock prices changed over time?*
- ✓ A rolling estimation was conducted using data for the most recent three years of the observation period.
- ✓ **No substantial changes in the relationship** between forecasts and stock prices **over time**.
- ✓ The t-values for R.FSE show a gradual decrease as the quantile Tau increases.

# Time Series Trends of Quantile-Specific R.FSE Coefficients and 95% Confidence Intervals



## 5. Robustness check

- ✓ The robustness of the analysis was confirmed through the following three approaches:
  1. Standardizing the data.
  2. Using Bloomberg data instead of Factset data.
  3. Calendar adjustment;  
using U.S. data as of Friday and domestic data as of the following Monday instead of Friday
- ✓ The findings were robust.

## 5. Robustness check: Result of standardizing the data

- ✓ The absolute values of R.FSE coefficients are relatively large.
  - A forecast change has considerable impact on stock price change.

Coefficients (t-values) from Quantile Regression

tau	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
R.NKY	-0.16(-2.01)	-0.07(-1.03)	-0.05(-1.02)	-0.07(-1.52)	-0.08(-1.74)	-0.12(-2.65)	-0.17(-3.75)	-0.15(-2.85)	-0.16(-2.5)
R.SPX	0.24(3.47)	0.18(3.07)	0.17(3.85)	0.16(3.56)	0.14(3.26)	0.08(1.99)	0.11(2.49)	0.06(1.31)	0.031(0.55)
R.JPY	0.09(1.57)	0.14(2.93)	0.12(3.37)	0.111(3.05)	0.13(3.38)	0.11(3.5)	0.13(3.86)	0.1(2.69)	0.06(1.3)
D.VNKY	0.0396(-0.72)	0.0456(0.78)	0.0584(1.34)	0.0499(1.15)	0.039(1.27)	0.0328(0.84)	0.06155(1.39)	0.036(0.76)	0.067(1.41)
D.GJGB	0.079(1.46)	0.03(0.62)	0.03(0.82)	0(0.11)	0(0.03)	0(-0.08)	0(-0.13)	-0.05(-1.48)	-0.02(-0.41)
D.SPREAD	-0.06(-1.17)	-0.02(-0.52)	-0.06(-1.85)	-0.03(-1.1)	-0.04(-1.21)	-0.05(-1.6)	-0.06(-3.5)	0(-0.03)	0.06(1.67)
R.FSE	0.16(3.12)	0.06(1.29)	0.08(2.41)	0.04(1.35)	0.03(1.18)	0(-0.16)	-0.04(-1.51)	-0.09(-2.76)	-0.09(-2.08)

Quantiles significant at the 5% level are highlighted.

## 6. Characteristics of forecasts by analyst type

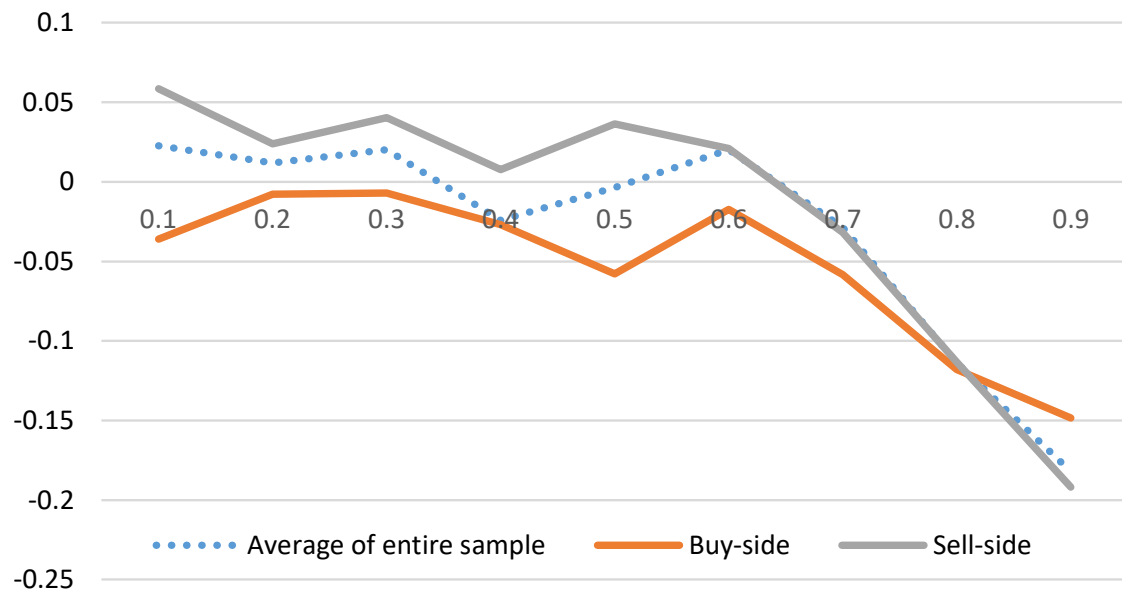
- ✓ *When forecast values are categorized by analyst type (sell/buy side), is there any difference in their relationship with stock prices?*
- ✓ We examine this using data from QUICK surveys that collected future stock price outlooks from various companies.
- ✓ **Quantile regression** is performed as before, except for **using sell/buy-side forecast** instead of FSE.
- ✓ Since these outlook values are derived from monthly surveys, following two approaches are implemented,
  1. using monthly change for forecast, while for the other variables, employing weekly changes at survey released timing,
  2. using monthly changes for all variables.



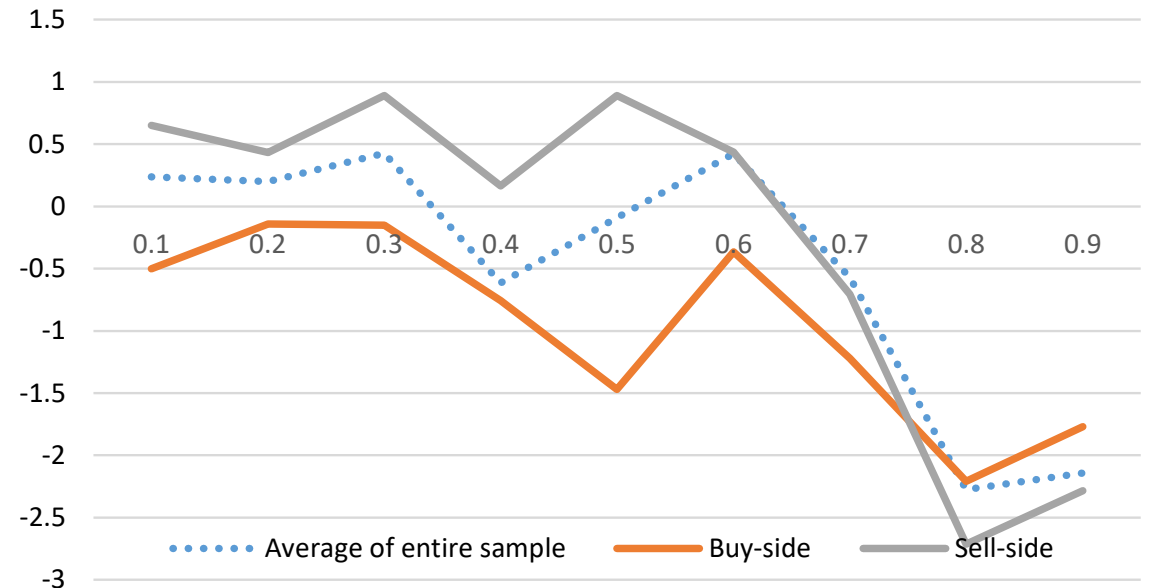
## 6. Result for 1

- ✓ When stock prices decline, the buy-side tends to revise forecasts upward in advance, while the sell-side tends to revise them downward.
- ✓ When stock prices rise, the sell-side tends to make relatively larger downward revisions on tau 0.9.
- ✓ **Different patterns between sell-side and buy-side forecasts** were observed, though it's not statistically verified yet.

Coefficients

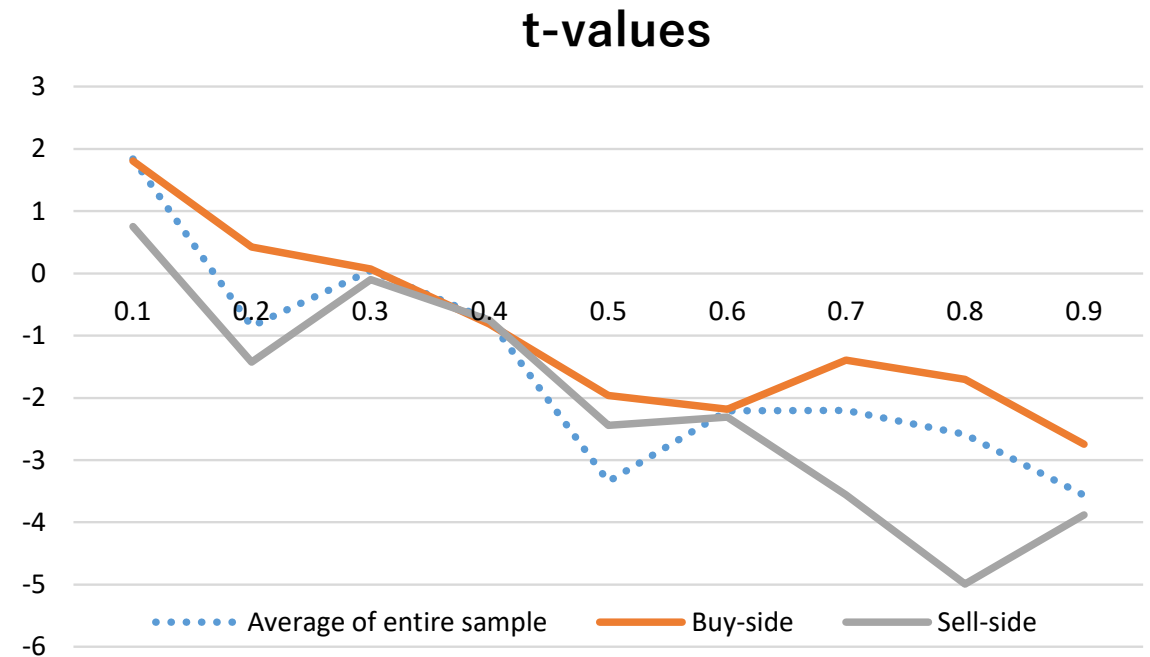
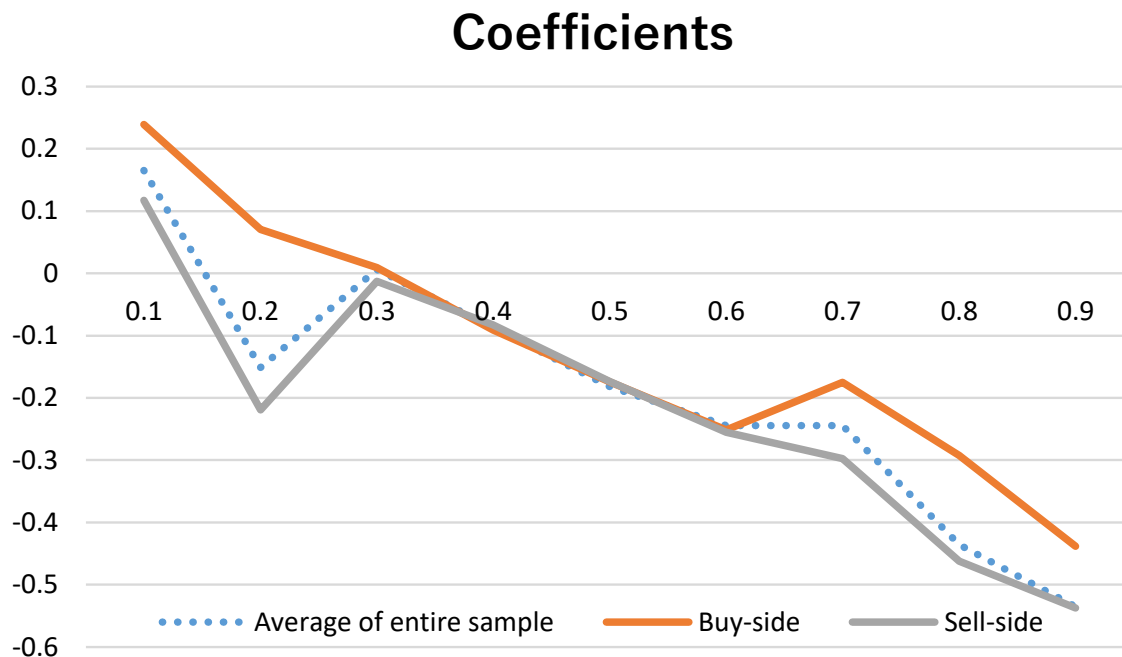


t-values



## 6. Result for 2

- ✓ When stock prices decline, buy-side tends to make larger downward revisions in advance.
- ✓ When stock prices rise, sell-side tends to make relatively larger downward revisions.
- ✓ Again, **different patterns between sell-side and buy-side forecasts** were observed, though it's not statistically verified yet.



## 7. Conclusion and future challenges

- ✓ We examined the **relationship between changes in stock index and its forecast** using the quantile regression.
- ✓ Before substantial changes in stock prices, forecasts tend to be revised downward in advance.
  - Direction/size of forecast change can be regarded as **a proxy for market uncertainty**.
  - The findings were robust.
- ✓ Time series analysis showed **no substantial changes in the relationship over time**.
- ✓ **Different patterns** between sell-side and buy-side forecasts were observed.
  - Statistical verification
  - Similar investigation by categorizing the FSE data with more frequency

# References

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