Investor Expectations and the Volatility Puzzle in the Japanese Stock Market

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Abstract

   Contrary to reasonable expectations regarding high-risk high-return, it is observed in actual equity markets that high volatility stocks tend to deliver low average return.

   Through empirical analysis of the Japanese stock market, we show that over-expectations on the part of investors and securities analysts can be the primary origin of this puzzle. High volatility stocks are likely to be given optimistic earnings forecasts and to become overvalued. Generally speaking, however, such expectations go too far and only relatively low returns are realized. Moreover, the existence of investors who expect extremely high return possibly causes the puzzle, and the future earnings growth of stocks with high earnings variability tends to be overestimated by securities analysts. These results suggest that expectation and volatility are closely linked.

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1. Introduction

The expectation that taking high risk brings high return is economically reasonable. Assuming investors are risk averse and there are two stocks with identical expected return, since they prefer the one with lower risk in terms of volatility or other risk measures, the expected return on it is expected to be appreciated. Replacing each risk and return with business risk and earnings cash flow, respectively, the same logic should be applied.

Meanwhile, in reality, do stocks with higher past volatility have higher return in the future? Many previous empirical studies generally show the opposite conclusion: stocks with higher volatility tend to have lower return[1]. We define 'the low volatility effect' as the mean return of low volatility stocks being equivalent to or higher than that of high volatility stocks. As will be confirmed later, the low volatility effect is thought to exist in the Japanese stock market. Since such an anomaly exists contrary to the expectation of high risk and high return, we term it 'the volatility puzzle'.

If this is the case, how can the volatility puzzle be explained? Baker et al (2010) point out that investors unreasonably prefer high volatility stocks because of a preference for lotteries, representativeness, and overconfidence, factors well-known in the behavioral finance field. Jiang et al. (2009) show that in the US stock market the low volatility effect can be reasonably explained by the tendency for the future earnings of companies with high short-term price volatility to be overestimated compared to realized earnings.

To find possible causes for the existence of the low volatility effect in the Japanese stock market we

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[1] Ang et al. (2006, 2009), well known for their study of the volatility effect, mainly focus on short-term volatility that is observed in the previous one month and examine the return addition effect. According to the results, in the stock markets of the US and developed countries, high volatility stocks give significantly low mean returns. However, it is reported that such significant return differences disappear if portfolio construction emphasis is changed from cap-weighting to equal weighting (Bali and Cakici [2008]) and are explained by the short-term return reversal effect (Fu [2009], Huang et al. [2010]). Another well-known paper, Blitz and van Vliet (2007), tests the performance differences for long-term volatility over the previous three years in terms of both mean return and risk-adjusted return. The paper shows that high volatile stocks post low mean returns and low Sharpe ratios in the future at a statistical significance for stocks in developed countries including Japan. Ishibe et al. (2009) report similar results. Meanwhile, Yamada and Uesaki (2009) indicate that the difference in Sharpe ratios is significant but that of mean returns not. To sum up the results, as for short-term volatility, the difference of mean returns is statistically significant although some counterevidence has been reported. As for long-term volatility that we focus on here, the difference in mean returns is not always significant but that in risk-adjusted returns is generally significant.

examine the following three hypotheses.

The first is based on the idea that the price volatility of a stock should reflect a company's earnings variability. Since a company engaged in a high earnings variability business should expect high profits corresponding to such high risk, the price volatility of its stock and expected return will reflect such expectation. We assume, however, that since, in reality, a volatile business does not tend to be rewarded by high returns and investors do not acknowledge this, high volatility stocks have lower future returns.

In the second hypothesis, not relating to earnings variability, the volatility effect is caused by the tendency that investors and securities analysts prefer high volatility stocks and take an optimistic view of future earnings but their forecasts are on average overestimated.

The third hypothesis is related to the existence of investors and investor behavior that accept low expected returns intentionally instead of extremely high returns that are rarely seen. In horse racing, the well-known "favorite-longshot bias" says that longshots (horses with high odds) tend to be overvalued and favorites undervalued (Thaler and Ziemba [1988]). We focus on the skewness of stock returns to examine this hypothesis. Since a stock with positive skewness, which means lower returns than the mean at high probability and higher returns than the mean at low probability, and high volatility tends to be traded by investors who are not risk-averse, expected risk premium for price volatility is assumed to be small. Boyer et al. (2010), and Uchiyama and Tamura (2010) point out this possibility.

In the rest of the paper we try to confirm the low volatility effect in the Japanese stock market over the last 30 years by constructing portfolios based on volatility or variability, and compare the attributions of each. Then, we examine the hypothesis through regression analysis.

2. Data

Table 1 gives definitions of the measures we examine. Since we focus on long-term variability, we define earnings variability as the standard deviation of annual reported ROE over the previous five fiscal years and price volatility as the standard deviation of monthly stock returns over the previous five years.

A detailed definition of corporate earnings is as follows.

In Japan, securities analysts and others usually update their earnings forecasts quarterly, while companies typically announce fiscal year results several months after their respective accounting period has ended. Since this timing difference makes comparison of reported and forecasted figures difficult, we use annual reports for our study. We calculate reported earnings by combining the previous fiscal year's reported earnings and those forecast for the current fiscal year and forecasted earnings by combining the current

fiscal year's forecasted earnings and those for the next fiscal year[2]. The timing of the announcement of results is taken into account.

We use consensus forecasted earnings, which are the average of all forecasted earnings released the previous 100 days by many brokers' analysts, Toyo Keizai, and the target companies themselves. The data is obtained from IFIS Japan and Nomura Research Institute. Reported and forecasted data on a consolidated basis has priority over company-specific accounting. All data, except forecasted earnings, was obtained from Nomura Research Institute.

We calculate stock returns with dividend at compound interest. The relevant short-term interest rate is deducted from ROE and stock returns. Our universe is all Tokyo Stock Exchange (TSE) 1st Section listed stocks for which all measures[3] are available. Some 4.4% of all companies were excluded from the universe at December 2008 due to lack of available data.

We adjust for outliers with respect to ROE, earnings to price ratio (E/P), book to price ratio (B/P), and skewness. If raw data is larger (or smaller) than the boundary which is 5.2 times medium absolute deviation from the universe's medium value (in the case of normal distribution, 3.5 times standard deviation from mean value), it is returned to the boundary value.

The start date for the analysis is December 1979, because we can use forecasted earnings data covering more than 90% of TSE 1st Section stocks since then. The end date is April 2009, because we needed data for the next fiscal year.

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3. Portfolio-based Analysis

3.1 Low volatility effect

Let us firstly confirm the low volatility effect.

At every month end, we construct quintile portfolios sorting by the level of price volatility of each individual stock and calculate the performance statistics of each portfolio. The weighting for each portfolio is equal. The results are summarized in Table 2.

Table 2 also indicates the intercepts calculated by the Fama and French (1993) (hereafter, FF) three factors model. The three factor return series of market, SMB (small cap minus big), and HML (high

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[2] Reported earnings are defined as the sum of monthly earnings for the last 12 months and forecasted earnings as the sum of monthly earnings for the next 12 months. For instance, in the case of companies whose accounting term end is March, its reported earnings data at end-June 2009 is the sum of 9/12 times reported annual earnings at end-March 2009 and 3/12 times forecasted annual earnings at end-March 2010. And, forecasted earnings data for the same date is the sum of 9/12 times forecasted annual earnings at end-March 2010 and 3/12 times forecasted annual earnings at end-March 2011.

[3] We exclude companies which become bankrupt in the next year, since reported ROE for the next year is necessary for the analysis.

book/price minus low) are measured based on Kubota and Takehara (2007)'s definitions with the TSE 1st Section universe. We regress the returns of each quintile portfolio or the return difference between the highest and the lowest quintile portfolios on the FF three factor return time series to estimate the FF intercept.

According to Table 2, the performance difference is significantly large—the quintile with the greatest volatility is 7 percentage points lower per annum in terms of mean return and 13.0 points higher per annum in terms of portfolio volatility than respective figures for the quintile with the least volatility. The differences in mean return, risk, and Sharpe ratio are all statistically significant. This return difference is not explained by FF factors.

Then, we see whether or not such economically and statistically significant return differences are explained by the three hypotheses.

3.2   Sorting by earnings variability

We now confirm the relationship between earnings variability and company attributions. At every month end, we construct equal-weighted quintile portfolios divided by level of earnings variability, and calculate figures for the measures in Table 1 and next month returns. The results are summarized in Table 3.

First, the high earnings variability quintiles feature high price volatility, and the highest quintile always indicates higher price volatility than the lowest quintile. High variability quintiles exhibit high forecast growth but similar ex-post reported growth for the future, which means future earnings are overvalued. Moreover, this quintile has low E/P and B/P. Thus, securities analysts and investors tend to be overconfident in the future achievement of companies with high earnings variability.

These results are consistent with the first hypothesis so far. However, the differences in returns and Sharpe ratios between the highest and lowest quintiles are small and not statistically significant. Therefore, we assume earnings variability is not directly related to the low volatility effect.

3.3   Sorting by price volatility

Next, Table 4 Panel A summarizes the means of the measures for the quintile portfolios based on the price volatility of individual stocks as we did previously for earnings variability.

According to the table, the quintile with the greatest volatility consists of small stocks and exhibits pronounced skewness during most periods, and always displays high earnings variability. Future earnings growth for this quintile is estimated high but in hindsight such forecasts tend to be overestimated, i.e. the forecast errors are negatively large, and the quintile is overvalued in terms of E/P and B/P.

These characteristics may contribute to the biases of some company attributions (such as sectors) but not stock price volatility. Therefore, we regress stock price volatility on their attributions including sector

dummies (Daiwa 7 sector classification) every month.

$$VolaEq_i = \beta_1 \cdot MV_i + \beta_2 \cdot BP_i + \sum_{j=1} \beta_{2+j} \cdot SD_{i,j} + \varepsilon_i \qquad (1)$$

where, VolaEq is the stock price volatility of stock i, MVi is its market capitalization, B/P is the book to price ratio, SDi,j is a dummy variable for industrial sector j, and the weight of each observation is set to 1.

Table 4 Panel B reports the descriptive statistics for quintile portfolios based on adjusted volatility. Due to adjustments for bias, size and B/P are almost flat across all portfolios. As in Panel A, the Q5 portfolio consists of firms with a high degree of skewness, bullish forecast growth, low ex post-reported growth, and low E/P. According to performance statistics, while this adjustment reduces the low volatility effect, significant differences in the Shape ratio and FF alpha remain.

These tendencies are consistent with the second hypothesis. Stocks with high volatility have high forecasted earnings growth and low E/P, which means investors and others hold high expectations for these stocks. However, such expectations will not generally be rewarded as implied by the tendency for ex-post earnings growth reported in the future to be relatively low. The room for realized stock return might be small if high expectations materialize, but return possibly drops sharply if not the case.

To confirm this point, we first divided the universe into three portfolios based on ex-post reported growth, then constructed quintiles based on stock price volatility in each portfolio, and calculated performance. The results are summarized in Table 5. Although no significant low volatility effect is observed in the high ex-post reported growth universe, an extremely strong low volatility effect is observed in the opposite universe. This result recalls that the cause of the low volatility effect is deeply related to ex-post reported growth.

4. Regression Analysis

We examined the relation between past volatilities and future stock returns through cross-section regression analysis in the same universe as the quintile portfolio.

By month, we executed cross-section regression where the dependent variable is next month's stock return (Rtn_i) and the independent variable the logarithm of volatility ($VolaEq_i$). To neutralize a stock's characteristics, we included a logarithm of market value (MV_i), B/P (BP_i) and sector dummy variables ($SD_{i,j}$) as independent variables. Moreover, to explain the low volatility effect, we added a logarithm for earnings variability ($VarEarn_i$), forecast growth ($FcGr_i$), ex-post reported growth ($FuGr_i$), forecast E/P (EP_i), and skewness ($Skew_i$) to the regression. In the case of using all measures, the regression formula is as follows:

$$Rtn_i = \beta_1 \cdot \log(VolaEq_i) + \beta_2 \cdot \log(VarEarn_i) + \beta_3 \cdot FcGr_i + \beta_4 \cdot FuGr_i + \beta_5 \cdot EP_i$$
$$+ \beta_6 \cdot Skew_i + \beta_7 \cdot \log(MV_i) + \beta_8 \cdot BP_i + \sum_{j=1} \beta_{8+j} \cdot SD_{i,j} + \varepsilon_i \qquad (2)$$

The weight of each stock in the regression is proportional to the square root of each stock's market value[4]. And, the independent variables are normalized in the universe (the difference from sample mean divided by sample standard deviation).

In Table 6, Panel A indicates p-value, which is the probability holding the null hypotheses that the time-series average of the cross-section regression coefficient (hereafter 'regression coefficient') is not statistically significantly different from zero. The regression formulae are listed A0 to A8. We add industry dummy variables to all formulae except A0, but omit their regression coefficients in all tables.

In formulae A0 and A1, the regression coefficient for volatility is statistically negatively significant, so the low volatility effect can be confirmed.

In A2 (adding earnings variability), the regression coefficient for earnings variability is positive but that for volatility shows expanded negative value. This means that earnings variability could not be the factor behind the low volatility effect. In A3 (adding forecast growth), the regression coefficient for forecast growth is positive but that for volatility shows expanded negative value, so forecast growth by itself cannot explain the low volatility effect either. On the other hand, in A4 to A6 (adding ex-post reported growth, forecast E/P, and skewness separately), the sign of the regression coefficient for each variable is what we expected and the negative value of the regression coefficient for volatility shrinks slightly to zero.

In A6 (adding skewness), the regression coefficient for skewness is statistically negatively significant. This means that stocks with past return distribution, where there is strong likelihood of low return below average and little likelihood of any extreme return above average, will show negative return relative to average in the future. Applying expectation utility based on cumulative prospect theory, Barberis and Huang (2008) evidenced theoretically that stocks with positive skewness in the past have negative relative return in the future. Our result is consistent with the evidence and is same as the results obtained in Uchiyama and Tamura (2010).

While there is only little change in the regression coefficient for volatility by adding skewness, the difference between the coefficient for volatility in A1 and in A6 is statistically significant at the 5% level. Therefore, we infer that skewness is one factor behind the low volatility effect, though the impact is not strong.

In A6 (adding all independent variables except ex-post reported growth), all signs (plus or minus) for each regression coefficient are as we expected, but the coefficient for volatility shrinks only slightly to zero.

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[4] A cross-section regression whose dependent variable is an individual stock's return generally caused heteroscedasticity as smaller stocks have larger error variance. It is known that the problem is empirically eased by weighting the samples in proportion to the square root of their market value.

In A8 (adding ex-post reported growth to A7), however, the coefficient for volatility shrinks considerably and the difference from zero is not statistically significant at the 10% level. It is also worth noting that the sign of the regression coefficient for forecast growth is inverted to negative (with increasing absolute value), and coefficients for ex-post reported growth and forecast E/P are higher. This means that a combination of higher forecast growth, higher forecast E/P, greater skewness, and lower ex-post reported growth can be the source of the low volatility effect, which is consistent with the second and third hypotheses. At the same time, the regression coefficient for B/P greatly decreases. This leads to the possibility that we can partially interpret the famous B/P effect (value anomaly) by the A8 formula as well as the low volatility effect.

Among independent variables in the cross-section regressions so far, we included ex-post (next year's) reported growth, which is unknown information at each regression point for the dependent variable (next one month's stock return). We do not think it likely that the low volatility effect has disappeared due to only including unknown information as long as there is only a small change in the regression coefficient for volatility in A1 and A4. To check this, we again effected monthly regression analysis where the dependent variable is the next one year's stock return, which enables both the dependent variable and independent variable to be known for the next one year. The results shown are in Table 6, Panel B. Each average and change (B0 through B8) for the regression coefficient for volatility in formulae B0 to B8 are similar to those in formulae A1 to A8 (shown on Panel A). The negative value of the regression coefficient for volatility shrinks greatly to zero by adding both forecast growth and ex-post reported growth to the regression.

Finally, we examine how performance difference between quintile portfolios in Table 2 changes according to forecast earnings, forecasted E/P, ex-post reported growth, and skewness. We add these measures to the right in formula (1) and make quintile portfolios based on the residual terms. Table 7 gives basic statistics and performance. By excluding the influence of these measures, the difference of return between Q1 and Q5 reverses to +0.4% and the difference in the Sharpe ratio becomes almost zero. The result is consistent with our regression analysis. If the expectation of investors and others was valid as a result and all stocks had the same skewness, the low volatility effect would be greatly diminished even from an economic viewpoint.

5. Discussion

Now we consider the main source of the low volatility effect is the second hypothesis. Although investors tend to hold great expectations for high volatility stocks as implied by high earnings forecasts and

low forecasted E/P, the expectation will, in general, not be rewarded and thus the volatile stocks give relatively low returns. In addition, the third hypothesis could be another source of the effect, but which is not as strong as the main one. High volatility stocks also tend to have high skewness of stock return distribution, and thus such high skewness regardless of high volatility leads future returns to be relatively low, on average. As for the first hypothesis, we consider that earnings variability has no direct relation with the low volatility effect.

Here we come to a fundamental question as to why high volatility is related to excess expectations and will thus have to know whether high volatility actually results in over-expectations or the opposite. This question can perhaps be explained from a behavioral finance standpoint.

As to why the low volatility effect still continues to be working, Baker et al. (2010) point out that most institutional investors are forced to be conscious of the benchmark. According to Yamada and Uesaki (2009), low volatility portfolios usually have much larger tracking error against the market index than typical active management strategies and therefore their excess returns are generally unstable. When institutional investors are ranked and evaluated in terms of excess return and tracking error, they will have a strong reluctance to incorporating the low volatility effect into their investment methodology, which means that commonly accepted performance evaluation based on market indices can be one source of the volatility puzzle.

6. Conclusion

We show that excess expectations on the part of investors and securities analysts can be the primary source of the puzzle between the expectation of high-volatility high-return and the reality of high-volatility low-return. In addition, we find it is possibly caused by the existence of investors/investor behavior that expect occasional extreme positive returns.

A simple way to apply the low volatility effect underlying the puzzle to practical investment is to decrease the weight of high volatility stocks and increase the weight of low volatility stocks. But, the method leads to increased tracking error against the benchmark (market index), and, for that reason, is unlikely to be justified referring to the performance evaluation standard based on the benchmark.

In the real securities markets, if the majority pursues a common course, it is well known that even individual rational investment behavior can bring the opposite result to ex-ante seemingly rational expectations. We believe that the low volatility effect is created and perpetuated by common investment knowledge, such as the expectation regarding high-risk high-return and performance evaluation based on the benchmark.

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Table 1 Measures

Variable	Description
Earnings variability	Standard deviation of reported ROE over past five fiscal years (per annum, available for at least four years)
Volatility	Standard deviation of monthly excess stock returns over past 60 months
Skewness	Skewness of returns same as in volatility
Reported ROE	[Reported earnings over past 12 months] / [Total common equity]
Forecast ROE	[Forecasted earnings over next 12 months] / [Total common equity]
Ex-post reported ROE	Ex-post reported ROE over next 12 months
Forecast E/P	[Forecasted earnings over next 12 months] / [Market capitalization]
B/P	[Total common equity] / [Market capitalization]

Table 2 Low Volatility Effect

	Low Q1	Volatility 2	3	4	High Q5		
Performance (per annum)						Q5-Q1	pV
Return (%)	5.5	4.7	3.9	2.7	−1.5	−7.0	4.9%
Risk (%)	15.1	18.7	21.4	23.8	28.1	13.0	0.0%
Sharpe ratio	0.37	0.25	0.18	0.11	−0.05	−0.42	0.1%
FF alpha (%)	3.0	1.8	1.1	0.1	−4.4	−7.4	0.6%

Table 3 Sorting by Earnings Variability

	Low Q1	Variability 2	3	4	High Q5	Q1>Q5	Q5>Q1
Average						Q1>Q5	Q5>Q1
Market cap (JPY billion)	232.5	242.7	240.1	236.9	211.7	26.9%	3.1%
Earnings variability (%)	1.5	2.8	4.4	7.3	14.6	0.0%	100.0%
Volatility (%)	30.3	31.9	34.1	37.5	42.1	0.0%	100.0%
Skewness	0.36	0.37	0.34	0.34	0.41	5.4%	45.0%
[A] Reported ROE (%)	9.7	10.0	10.0	10.5	9.7	38.5%	39.9%
[B] Forecast ROE (%)	10.2	10.7	10.9	11.7	12.7	26.9%	49.0%
[C] Ex-post reported ROE (%)	9.3	9.6	9.5	9.9	9.5	41.4%	40.5%
[B]-[A] Forecast growth	0.5	0.7	0.8	1.2	2.9	5.7%	73.9%
[C]-[A] Ex-post reported growth	−0.4	−0.4	−0.6	−0.6	−0.2	41.9%	39.1%
[C]-[B] Forecast error	−0.9	−1.1	−1.4	−1.8	−3.2	64.0%	12.7%
Forecast E/P (%)	7.9	8.0	7.7	7.4	6.3	69.4%	14.2%
B/P (%)	76.0	75.5	72.7	67.8	53.7	95.8%	1.4%
Performance (per annum)						Q5-Q1	pV
Return (%)	3.2	3.8	3.4	2.9	2.7	−0.4	84.0%
Risk (%)	18.4	18.7	19.8	22.2	26.0	7.6	0.0%
Sharpe ratio	0.17	0.21	0.17	0.13	0.11	−0.07	34.0%
FF alpha (%)	0.5	1.5	0.7	0.0	−0.3	−0.8	61.8%

'Q1>Q5' represents the event ratio defined as follows—we calculate the number of months in which the mean value of Q1 is greater than that of Q5 at the significance level of 5% for a two-sided test, and take the ratio of the months to the total number of sample. Similarly, 'Q5>Q1' shows the ratio for the opposite case. 'Q5-Q1' under 'Performance' is the

difference in the performance measures between Q5 and Q1, 'pV' is p-value for a two-sided test of the null hypothesis to show that there is no difference between Q5-Q1.

Table 4   Sorting by Volatility

	Low Q1	Volatility 2	3	4	High Q5		
Panel A Not adjusted							
Average						Q1>Q5	Q5>Q1
Market cap (JPY billion)	331.2	270.0	241.0	191.7	129.5	75.4%	3.1%
Earnings variability (%)	3.9	4.7	5.8	7.0	9.1	0.0%	100.0%
Volatility (%)	21.7	29.1	34.2	39.7	51.2	0.0%	100.0%
Skewness	0.29	0.25	0.31	0.38	0.59	1.1%	84.1%
[A] Reported ROE (%)	9.4	10.2	10.1	10.3	10.0	35.7%	39.4%
[B] Forecast ROE (%)	10.1	10.9	11.2	11.7	12.2	27.5%	52.7%
[C] Ex-post reported ROE (%)	9.3	9.7	9.7	9.8	9.3	40.2%	34.0%
[B]-[A] Forecast growth	0.7	0.8	1.0	1.4	2.2	2.0%	74.8%
[C]-[A] Ex-post reported growth	−0.2	−0.5	−0.5	−0.4	−0.7	34.8%	32.3%
[C]-[B] Forecast error	−0.8	−1.2	−1.5	−1.9	−2.9	56.9%	6.2%
Forecast E/P (%)	8.0	8.1	7.8	7.2	6.4	70.3%	10.5%
B/P（%）	72.7	73.3	71.7	68.1	60.0	77.1%	13.0%
Panel B Adjusted (Size, B/P, and sectors)							
Average						Q1>Q5	Q5>Q1
Market cap (JPY billion)	239.8	229.6	237.7	216.8	240.4	0.0%	0.0%
Earnings variability (%)	4.4	5.1	5.9	6.8	8.4	0.0%	100.0%
Volatility (%)	23.6	29.5	33.9	39.1	49.7	0.0%	100.0%
Skewness	0.24	0.27	0.33	0.41	0.57	0.0%	97.5%
[A] Reported ROE (%)	10.6	10.4	10.2	9.8	8.9	52.4%	18.1%
[B] Forecast ROE (%)	11.4	11.3	11.3	11.2	10.9	43.9%	30.3%
[C] Ex-post reported ROE (%)	10.3	10.0	9.9	9.4	8.2	53.3%	10.2%
[B]-[A] Forecast growth	0.8	0.8	1.1	1.4	2.0	1.1%	65.2%
[C]-[A] Ex-post reported growth	−0.3	−0.4	−0.4	−0.4	−0.7	30.3%	17.3%
[C]-[B] Forecast error	−1.1	−1.3	−1.5	−1.9	−2.7	56.4%	3.1%
Forecast E/P (%)	7.5	7.8	7.8	7.6	6.7	55.2%	7.4%
B/P（%）	65.6	70.7	70.8	71.6	67.2	0.0%	0.3%
Performance (per annum)						Q5-Q1	pV
Return (%)	3.9	3.9	3.9	3.5	0.4	−3.5	24.7%
Risk (%)	15.8	18.9	20.9	23.4	27.2	11.4	0.0%
Sharpe ratio	0.25	0.21	0.19	0.15	0.02	−0.23	2.6%
FF alpha (%)	1.8	1.4	1.3	0.6	−3.1	−4.9	2.9%

See notes to Table 3. Performance in Panel A is the same as in **Table 2**.

Table 5   Volatility Effect in Universes Divided by Ex-post Reported Growth

| | Low | Volatility | | | High | | |
	Q1	2	3	4	Q5	Q5-Q1	pV
High ex-post reported growth universe							
Average return (% p.a.)	13.3	16.6	17.6	16.3	10.9	−2.4	51.9%
FF alpha (% p.a.)	10.7	13.4	14.1	13.3	6.6	−4.1	16.5%
Medium ex-post reported growth universe							
Average return (% p.a.)	5.3	4.2	4.9	3.4	−0.6	−5.9	8.5%
FF alpha (% p.a.)	2.3	0.9	1.6	0.3	−4.5	−6.9	0.8%
Low ex-post reported growth universe							
Average return (% p.a.)	−3.4	−6.5	−8.7	−10.2	−13.1	−9.7	0.6%
FF alpha (% p.a.)	−5.9	−9.7	−11.8	−12.7	−15.6	−9.7	0.1%

'Q5-Q1', the second column from the right, is the difference in performance measures between Q5 and Q1, 'pV' is p-value for a two-sided test of the null hypothesis that there is no difference between Q5-Q1.

Table 6 Regression Results

		Volatility	Earnings variability	Forecast growth	Ex-post reported growth	Forecast E/P	Skewness	Market cap	B/P	R-squared
Panel A	Next month return (%) as regressand									
A0	Coef	−0.31								1.7%
	pV	0.0%								
A1	Coef	−0.24						−0.02	0.44	29.5%
	pV	0.7%						85.5%	0.0%	
A2	Coef	−0.26	0.06					−0.01	0.45	29.8%
	pV	0.2%	10.5%					92.9%	0.0%	
A3	Coef	−0.25		0.06				−0.01	0.46	29.7%
	pV	0.5%		4.7%				91.0%	0.0%	
A4	Coef	−0.22			0.76			0.01	0.44	30.4%
	pV	1.4%			0.0%			94.6%	0.0%	
A5	Coef	−0.21				0.41		0.00	0.38	30.3%
	pV	1.6%				0.0%		96.0%	0.0%	
A6	Coef	−0.23					−0.11	−0.03	0.42	29.7%
	pV	1.1%					0.1%	74.5%	0.0%	
A7	Coef	−0.21		0.06		0.40	−0.09	0.00	0.38	30.7%
	pV	1.8%		3.0%		0.0%	0.6%	99.6%	0.0%	
A8	Coef	−0.13		−0.37	1.01	0.58	−0.09	0.00	0.28	31.7%
	pV	11.7%		0.0%	0.0%	0.0%	0.5%	97.4%	0.0%	
Panel B	Next year return (% per month) as regressand									
B0	Coef	−0.28								2.5%
	pV	12.6%								
B1	Coef	−0.24						−0.01	0.28	42.7%
	pV	14.9%						95.1%	0.0%	
B4	Coef	−0.22			0.64			0.00	0.27	47.6%
	pV	13.9%			0.0%			98.0%	0.0%	
B7	Coef	−0.22		−0.03		0.15	−0.03	−0.01	0.25	43.9%
	pV	12.8%		37.9%		9.5%	28.7%	97.3%	0.1%	
B8	Coef	−0.16		−0.40	0.86	0.30	−0.03	−0.01	0.17	50.7%
	pV	23.3%		0.0%	0.0%	0.0%	23.6%	93.5%	1.5%	

'Coef' is the average of regression coefficients in time-series, 'R-squared' the average of adjusted R-squared, and 'pV' p-value for a two-sided test of the null hypothesis H(0): regression coefficient =0. p-values in Panel B are Newey-West adjusted.

Table 7   Sorting by Adjusted Volatility

	Low		Volatility		High		
	Q1	2	3	4	Q5		
Average						Q1>Q5	Q5>Q1
Market cap (JPY billion)	243.4	233.1	228.0	210.8	249.1	0.0%	0.3%
Earnings variability (%)	4.7	5.2	5.9	6.6	8.2	0.0%	100.0%
Volatility (%)	24.1	29.8	34.0	38.9	49.1	0.0%	100.0%
Skewness	0.41	0.33	0.32	0.36	0.41	0.0%	1.4%
[A] Reported ROE (%)	9.4	9.8	10.2	10.3	10.4	0.3%	31.7%
[B] Forecast ROE (%)	10.7	10.9	11.3	11.5	11.8	0.0%	32.3%
[C] Ex-post reported ROE (%)	8.9	9.3	9.8	9.9	9.9	0.0%	34.0%
[B]-[A] Forecast growth	1.4	1.1	1.1	1.1	1.4	0.3%	0.0%
[C]-[A] Ex-post reported growth	−0.5	−0.5	−0.3	−0.5	−0.5	0.0%	0.0%
[C]-[B] Forecast error	−1.8	−1.6	−1.5	−1.6	−1.8	0.0%	0.3%
Forecast E/P (%)	7.2	7.5	7.7	7.7	7.3	0.3%	0.3%
B/P (%)	66.1	70.6	71.0	71.1	67.2	0.0%	0.8%
Performance (per annum)						Q5-Q1	pV
Return (%)	2.2	3.2	3.7	4.1	2.6	0.4	89.0%
Risk (%)	16.2	19.1	21.1	22.9	26.4	10.2	0.0%
Sharpe ratio	0.14	0.17	0.17	0.18	0.10	−0.04	69.4%
FF alpha (%)	0.2	0.7	1.1	1.2	−1.0	−1.1	63.0%

See notes to Table 3.