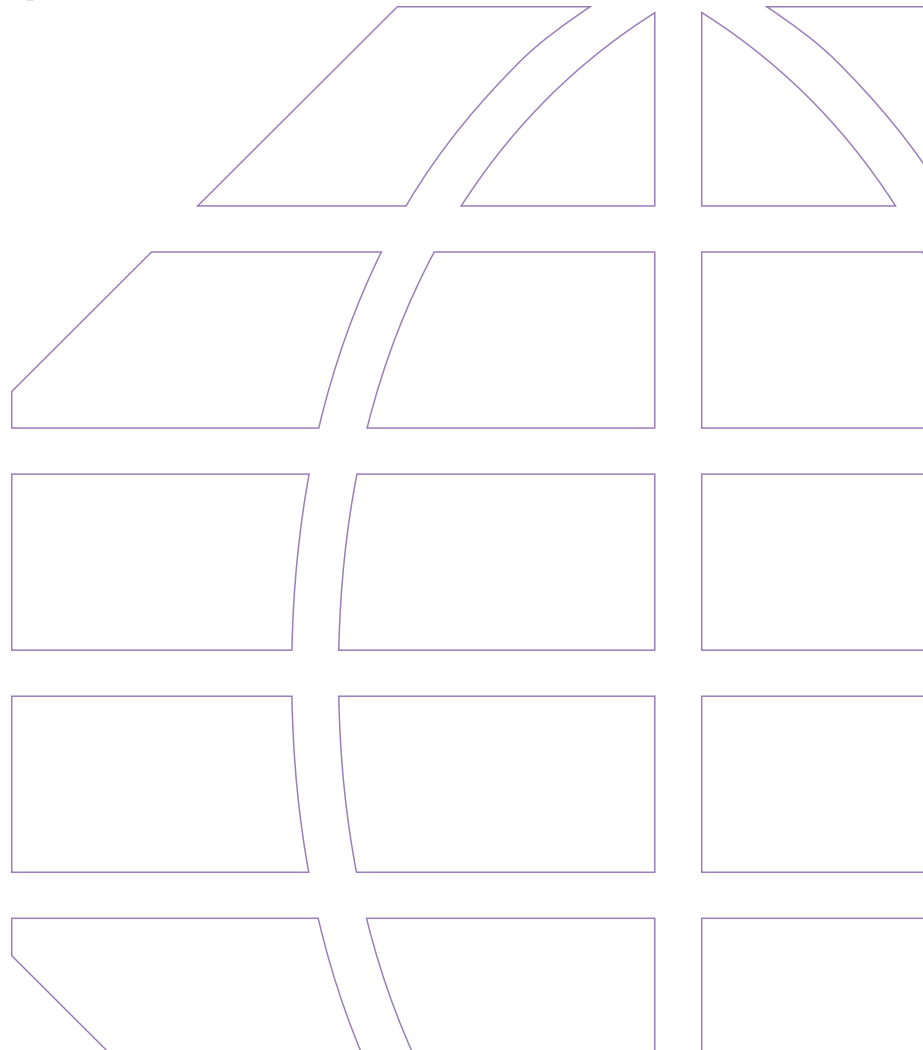


RESEARCH AND PRODUCT DEVELOPMENT

# CME Group Yen-Denominated Nikkei 225 Index Futures Performance

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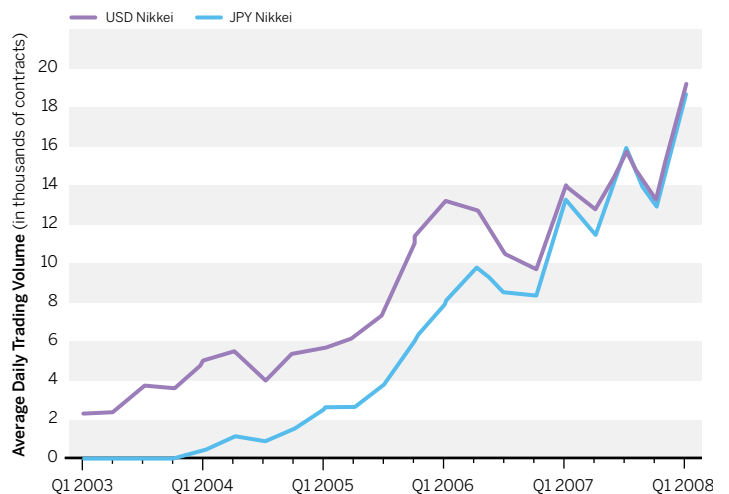
This article presents and tracks the recent performance of the Nikkei 225 futures contract against the Nikkei 225 Index.

In spite of the disadvantage of trading outside of its natural time zone, the trading activity of Nikkei 225 Index futures at CME Group has shown significant growth in recent years, especially following the introduction of the Japanese yen-denominated contract in 2004 to accompany the original U.S. dollar-denominated version (see Exhibit 1).

The focus of this article is to track the recent performance of the futures contract against the Nikkei 225 Index. Specifically, if a market participant were to use the product to gain exposure to the Japanese stock market, how would he/she fare in terms of coming close to the performance of the underlying stock portfolio represented by the index? The two aforementioned versions of the equity index futures trade at CME Group, denominated in Japanese yen and U.S. dollars, respectively. The natural choice for performance comparison is the Japanese yen-denominated version, which carries a contract multiplier of JPY 500. Because the profit and loss for this contract is calculated in yen, the contract offers an “apple-to-apple” comparison against a stock portfolio as represented in the underlying index. You can find a discussion of the relative performance of the two futures with different currency denominations in a companion article.<sup>1</sup>

#### EXHIBIT 1:

Average Daily Trading Volume, CME Group U.S. Dollar-Denominated and Japanese Yen-Denominated Nikkei 225 Index Futures



#### Note on the Calculation Methodology

The monthly performance of the cash index is determined by the price series plus the monthly dividends accrued, added at the end of the month. The performance of the futures contract, however, is not simply the percentage change of the futures prices. Futures contracts are “unfunded” instruments. One does not pay the price of the futures contract in cash. The money can be deployed in interest accruing instruments and serves as collateral. If one commits 100 percent of the cash index to collateralize the index futures position, no leverage is involved. This would level the playing field for the index stock portfolio and the futures position and would make the performance comparison fair.

The interest accruing ability, of course, depends on the choice of the instrument. There is no universally applicable performance calculation for the futures strategy. In our calculation below, we employed one-month TIBOR as the money market instrument.<sup>2</sup>

Thus, the performance calculation for the futures strategy is the futures price change for the month, divided by the initial cash index value, plus the interest accrual for the month.<sup>3</sup> Prior to the expiration of the lead month futures contracts, the position is assumed to “roll over” to the subsequent quarterly contract at the settlement prices of the day. This rollover is assumed to happen on the first business day of the week of the expiration Friday.

**EXHIBIT 2:**CME Group Japanese Yen-Denominated Nikkei 225 Index Futures  
Monthly Tracking Error.

	PERFORMANCE		TRACKING ERROR (bps)
	Index	Futures	
Mar-04	6.58%	6.35%	-23.3
Apr-04	0.40%	-1.66%	-205.6
May-04	-4.46%	-3.01%	145.0
Jun-04	5.57%	6.95%	137.8
Jul-04	-4.49%	-5.64%	-115.3
Aug-04	-2.14%	-1.76%	37.8
Sep-04	-2.03%	-2.34%	-31.4
Oct-04	-0.48%	-1.06%	-57.6
Nov-04	1.19%	1.17%	-2.6
Dec-04	5.45%	5.92%	47.7
Jan-05	-0.88%	-1.00%	-12.0
Feb-05	3.12%	3.30%	17.7
Mar-05	-0.12%	-1.40%	-127.6
Apr-05	-5.66%	-5.65%	0.6
May-05	2.43%	2.46%	2.4
Jun-05	2.76%	2.75%	-0.5
Jul-05	2.73%	3.07%	34.2
Aug-05	4.33%	5.38%	104.9
Sep-05	9.69%	9.27%	-42.3
Oct-05	0.24%	0.12%	-12.2
Nov-05	9.30%	8.64%	-66.3
Dec-05	8.37%	8.58%	20.9
Jan-06	3.35%	2.67%	-67.1
Feb-06	-2.64%	-3.57%	-92.9
Mar-06	5.71%	6.43%	71.1
Apr-06	-0.90%	-0.43%	46.7
May-06	-8.51%	-7.53%	97.3
Jun-06	0.28%	-1.02%	-130.4
Jul-06	-0.31%	-0.40%	-9.4
Aug-06	4.45%	4.27%	-18.2
Sep-06	0.25%	0.12%	-12.9
Oct-06	1.69%	1.64%	-4.2
Nov-06	-0.76%	-0.85%	-9.4
Dec-06	5.90%	6.42%	52.8
Jan-07	0.92%	0.99%	7.6
Feb-07	1.30%	0.46%	-83.5
Mar-07	-1.35%	-1.37%	-1.8
Apr-07	0.65%	0.40%	-25.3
May-07	2.73%	3.79%	105.4
Jun-07	1.51%	1.23%	-28.7
Jul-07	-4.90%	-5.60%	-69.7
Aug-07	-3.92%	-3.16%	75.3
Sep-07	1.71%	0.94%	-77.0
Oct-07	-0.29%	0.69%	97.2
Nov-07	-6.31%	-6.25%	6.3
Dec-07	-2.32%	-3.88%	-156.1
Jan-08	-11.20%	-10.26%	93.8
Feb-08	0.12%	-2.05%	-216.2
Mar-08	-7.24%	-4.75%	249.5
Average			-5.1
Standard Deviation			87.8
Autocorrelation			-0.39

**Futures Tracking Performance**

Exhibit 2 shows the 49-month history of the monthly tracking performance of the CME Group Japanese yen-denominated Nikkei 225 Index futures. Tracking error is defined as the performance of the futures strategy less the performance of the index portfolio, as discussed in the immediately preceding section. Some noteworthy observations:

- On average, the futures performance mirrors that of the index. The average monthly tracking error is approximately -5 basis points, a magnitude that is not statistically different from zero; however,
- The dispersion of the tracking error can be quite large, as demonstrated by the measured standard deviation of 88 basis points.
- Further, the tracking error from month to month tends to “self-correct”; a deviation in the current month tends to induce a deviation in the following month in the opposite direction, as demonstrated by the negative autocorrelation.

The latter two observations can be explained by examining the timing of the mark-to-market process. Specifically, the spot Nikkei 225 Index is measured at the close of Japanese trading day. The Nikkei 225 Index futures will only start trading following the close of the Japanese trading day and continue until the close of the U.S. trading day. Therefore, the settlement price of the futures will reflect all market information accrued since the close of the Japanese trading day. As such, the futures price can depart from the “fair value” that would have been in line with the closing index value of the same day.

Indeed, Exhibit 3 shows the intra-day correlation between the yen-denominated Nikkei futures and the U.S. domestic index futures, sampled from March 10, 2008, through April 4, 2008, from 6 a.m. Central Time through the end of U.S. trading each day. While the correlations between Nikkei 225 Index futures and the U.S. domestic indexes are not as high as those among the U.S. domestic indexes, they are still strongly positive, and as high as 0.84, which is comparable to the intra-day correlation between S&P 500 and Russell 2000 during that period.

**EXHIBIT 3:**

## Intra-day Correlation Between Nikkei 225 Index Futures and U.S. Domestic Index Futures.

	Nikkei 225	E-mini S&P 500	E-mini Dow (\$5)	E-mini Russell 2000
<b>Nikkei 225</b>	1.00	0.84	0.82	0.74
<b>E-mini S&amp;P 500</b>		1.00	0.97	0.87
<b>E-mini Dow (\$5)</b>			1.00	0.85
<b>E-mini Russell 2000</b>				1.00

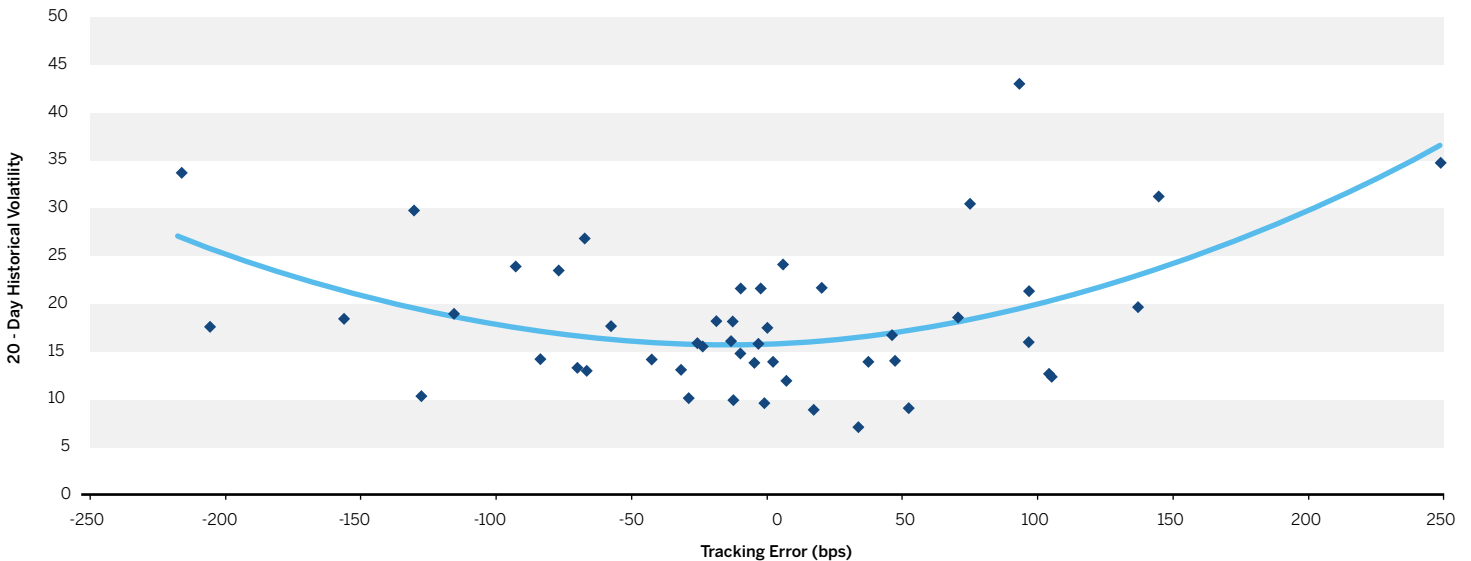
Therefore, the evidence lends credence to the notion that the incremental market information is priced into the Nikkei 225 Index futures following the close of the Japanese trading day.

When the market rallies following the close of the Japanese market, the futures closing mark will be high relative to the close of the spot index, leading to a higher current month performance. However, the higher settlement price of the futures contract this month will set a higher starting value for next month, thereby lowering the performance of the futures in the next month. This gives rise to the negative autocorrelation in the tracking error shown in Exhibit 2.

If the foregoing is true, the magnitude of the tracking error should be influenced by market volatility. When the market is more volatile, the extent to which the futures settlement deviates from the fair value based on the spot index closing mark is greater; therefore, the tracking error tends to be higher. Exhibit 4 shows some evidence supporting this theory. While there are only 49 data points, the large tracking errors tend to be observed when the volatility, as measured by 20-day historical volatility of the spot index, is high. While there is some considerable dispersion, the observable pattern seems to corroborate this theory.

#### EXHIBIT 4:

Monthly tracking error of the JPY-denominated Nikkei 225 Index futures vs. 20-day historical volatility of the index. The blue line shows the closest quadratic approximation of the relationship between the two quantities.



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- 1 The companion article, "Spreading CME Group Dollar-Denominated and Yen-Denominated Nikkei 225 Index Futures," is available at the CME Group Web site. Please visit [www.cmegroup.com/equityindexresearch](http://www.cmegroup.com/equityindexresearch).
- 2 For comparison purposes, we have also used the monthly averages of the domestic interbank unsecured overnight call rate. The performance differences averaged to a few basis points per month below those of the one-month TIBOR.
- 3 Based on the settlement prices of the lead month contract at the end of the month, versus that at the end of the previous month.

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