MIT Sloan School of Management

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E52-435

Finance Theory 15.415
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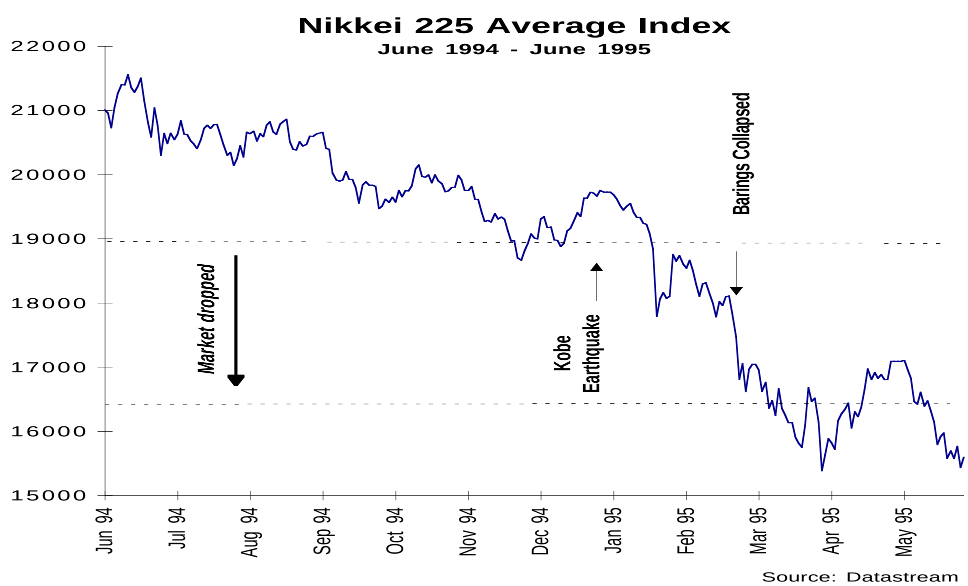
Solution to Assignment 5: Options

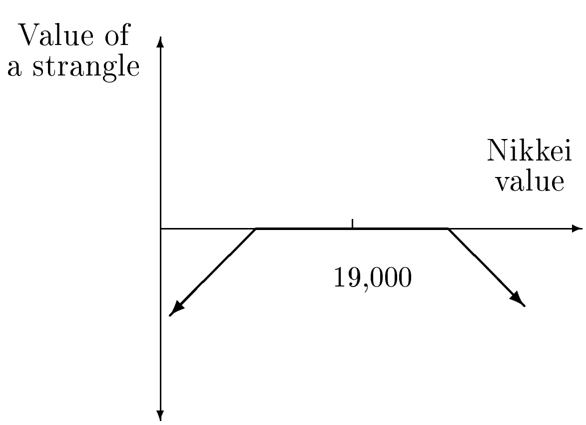
1. Baring Securities

(a) The strategy in options is described in the article as one where, "these trades obligated Barings to sell the Nikkei-225 index when it neared 20,000 and to buy it when it fell close to 18,000, positions that would generate huge losses if the market moved sharply in either direction." This position is a 'short strangle,' which entails selling calls and puts at different strikes. (This is in contrast to a straddle where the calls and puts are at the same strike.)

The reason for executing a short straddle position is to generate income from the sale of the options, with the expectation that the underlying (in our case, Nikkei) will not move sharply. As the figure below shows, this is not what happened.



(b) The payoff profile of a 'short strangle' is given below. From the figure, we see that losses will mount as the Nikkei index moves outside the range 18,000–20,000.



2. Investing in S&P 500 without downside risk

(a) The payoff from investing \$1 in "the contract" can be expressed as

$$\text{payoff} \;= \max\left[.6\left(\frac{S^\star - S_0}{S_0}\right) + 1, 1\right]$$

where $S^\star$ is the S&P index value one year from now, and S_0 is its current value.

(b) Since the contract pays off at least \$1 for each dollar invested *plus* 60% of the return on the market (if that return is positive), the contract can be replicated by a portfolio consisting of

- a risk-free discount bond with face value \$1
- .6 call options that pay $\max\left(\frac{S^\star - S_0}{S_0}, 0\right)$.

(c) The tree for the S&P 500 is:

\$1 — $u = 1.2$
\$1 — $d = .8$

and for the contract to be valued is:

? — \$1.12
? — \$1.00

implying that:

$$\begin{aligned} R &= 1.1 \\ u &= 1.2; \quad d = 0.8 \\ q_u &= \frac{1.1 - .8}{1.2 - .8} = .75; \quad q_d = \frac{1.2 - 1.1}{1.2 - .8} = 0.25. \end{aligned}$$

Using risk-neutral pricing, the value of this contract is $\frac{1}{1.1}\left[.75(1.12) + .25(1)\right] = 0.9909$. Given that the contract costs one dollar, you lose money by investing in this seemingly attractive contract!