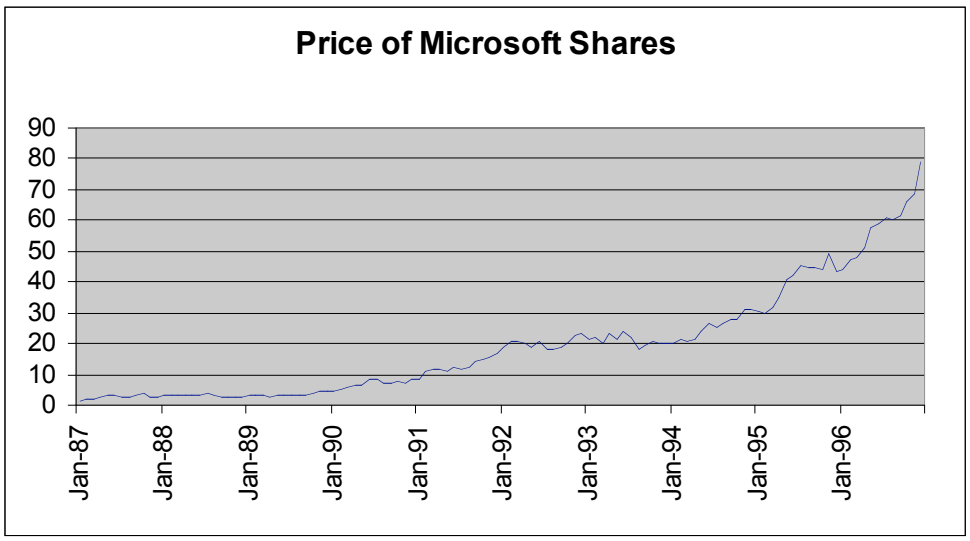
Economics 487

Homework #1 Solution Key
Return Calculations

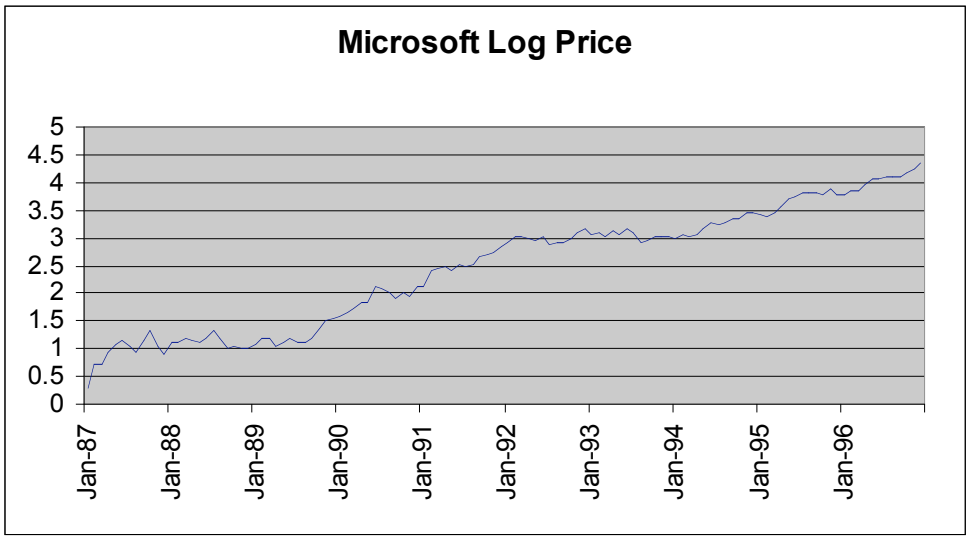
A. Excel Exercises: *(10 points)*

1. Make a time plot of the monthly price data over the sample period of January 1987 through December 1996. Paste your plot in a word processor file and type some general comments on what you see below the plot (e.g., "the price increases exponentially over time").



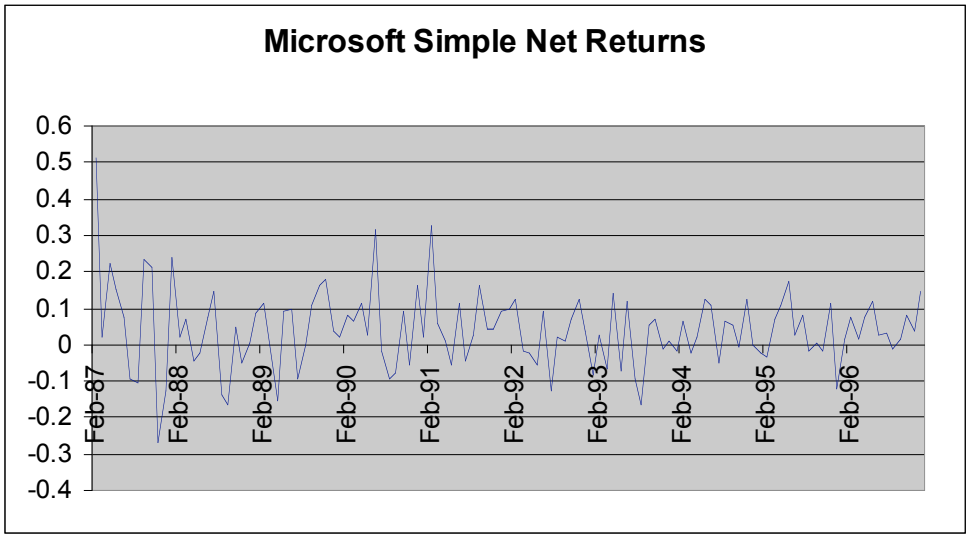
The price increases over time in an exponential fashion. The price becomes more volatile as the price level increases.

2. Make a time plot of the natural logarithm of monthly price data over the same sample period. Again, paste and comment. Compare with the plot of the raw data. Why is it generally more informative to look at a plot of the log of prices than a plot of the raw data?



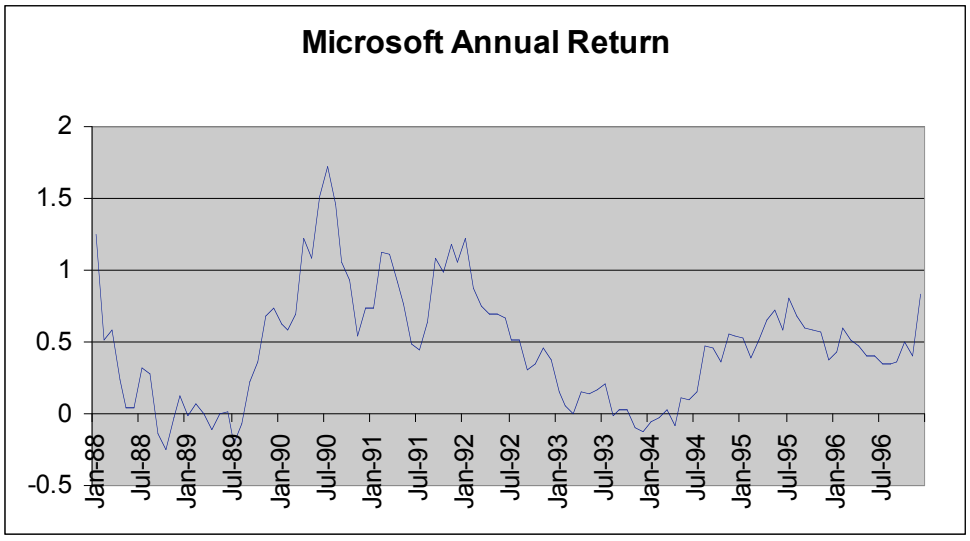
The log price is more linear than the price level. The variance of the log price movements seems more uniform. The plot is more informative since changes in the log price measure (continuously compounded) returns.

3. Using the monthly price data over the same sample period, compute the "simple" (no compounding) monthly returns (note: Microsoft does not pay dividends). Make a time plot of the monthly returns. (Note: you will not have a return for Jan. 1987. The first return will be for Feb. 1987.) Paste and comment, giving the formula used to calculate the simple returns.



(Simple net returns are reported. Simple gross returns is fine.) The simple returns suggest that the Microsoft return is highly variable from month to month, although the average return is obviously greater than zero. Formula $R_t = P_t / P_{t-1} - 1$.

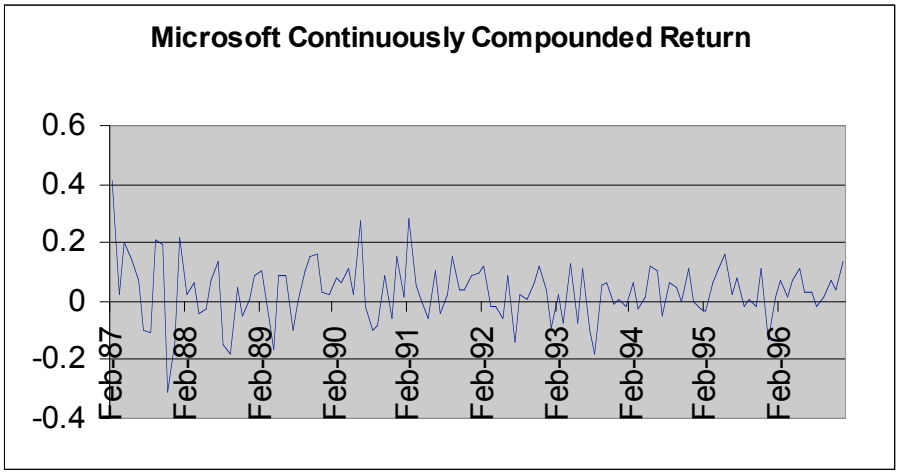
4. Using the simple monthly returns, compute simple annual returns for the each month in the sample period. (Note: do not calculate the "annualized" return—i.e., what you would earn if you obtained the same monthly return for a whole year—but instead calculate what the realized return was for the past twelve months.) Make a time plot of the annual returns. Paste and comment, giving the formula used to calculate annual returns.



The annual return series is much smoother than the monthly series. This is due to the overlapping structure of the annual return on a month-to-month basis. The net annual return is almost always positive and was as high as 150% in 1990. Formula

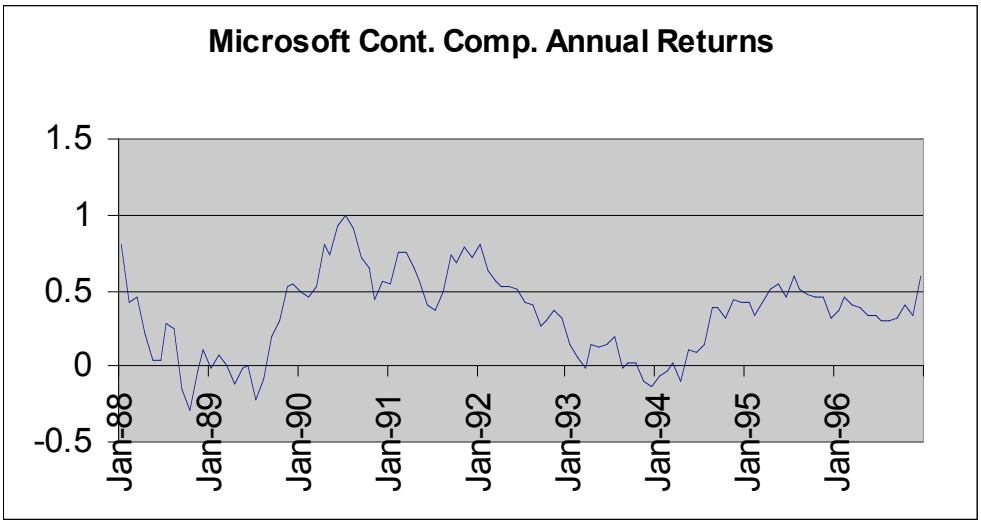
$$R_t(12) = P_t / P_{t-12} - 1 = \left(\prod_{j=0}^{11} (1 - R_{t-j}) \right) - 1.$$

5. Using the monthly price data over the January 1987 through December 1996 sample period, compute the continuously compounded monthly returns. Make a time plot. Paste and comment, giving the formula used to calculate continuously compounded returns. Compare the continuously compounded returns with the simple monthly returns. Why are the continuously compounded returns smaller?



The continuously compounded returns look very similar to the simple net returns. However, the continuously compounded returns are smaller than simple returns since the returns are compounded (continuously) throughout a given month. That is, to obtain the same price movement for the whole month a smaller return is necessary when there is compounding since the principle to which the return is applied changes throughout the month due to the compounding. Formula $r_t = \ln(1 + R_t) = \ln(P_t / P_{t-1})$.

6. Using the continuously compounded monthly returns, compute continuously compounded annual returns for each month in the sample period. Make a time plot. Paste and comment, giving the formula used to calculate annual continuously compounded returns.



Plot looks similar to simple net annual returns. Smaller again. Formula

$$r_t(12) = \sum_{j=0}^{11} r_{t-j} = \ln(1 + R_t(12)).$$