# Econ 520 (Spring 2007)

## A LECTURE NOTE ON STOCK MARKET CRASHES AND BUBBLES

Masao Ogaki

This lecture note explains the materials entitled *Application* on pp.172-173 in Mishkin's textbook.

Many economists believe that stock market crashes are related to a *bubble*. When the price of a share of stock is driven up beyond its fundamental value (the present value of the future dividends) because of a belief that it can be resold for an even higher price in the future, there is said to be a (speculative) bubble in the stock price.

Let $D_t$ be a dividend at $t$ per share and $P_t$ be the price of the stock. Then

$$P_t = b_t + \frac{D_t(1+g)}{1+k_e} + \frac{D_t(1+g)^2}{(1+k_e)^2} + \frac{D_t(1+g)^3}{(1+k_e)^3} + \dots \tag{1}$$

where $b_t$ is a bubble.

For example, suppose that Irving the investor is offered a share of stock for \$100 and it is known that the stock is fundamentally worthless because it will never pay a dividend. Assuming that Irving is risk neutral and that the interest rate is 10%, he is willing to hold the stock as long as he expects that he can sell the stock to someone one year from now for \$110. Why would anyone buy this stock from Irving? If Jane expects that the stock price will continue to rise and will be \$121 two years from now, then she will be willing to buy the stock from Irving for \$110.

It is theoretically possible for a bubble to expand forever under certain conditions, but it is more realistic for a bubble to have a probability of bursting. For example, imagine that Irving thinks that the stock price will fall to zero (the bubble bursts) with probability 0.5 but it will rise to \$220 with probability 0.5. Then the expected stock price is \$110 and Irving is happy to hold the stock.

When a bubble actually bursts, a stock market crash occurs in which stock prices sharply fall. Many economists argue that the U.S. stock market crash in 1987 in the U.S., the Teach Crash of 2000, and the Japanese stock market crash in 1990 were caused by the burst of a bubble. There is little reason to believe that the fundamental value of the firms fell so suddenly in these stock market crashes.

Many financial economists watch price-earnings ratios ($P/E$ ratios) as indicators of bubbles. The $P/E$ ratio is the ratio of a stock's price to its earnings per share (typically over the past one year). When the $P/E$ ratio is high, it is more likely that the stock price is high because of a bubble.

To understand this, assume that the growth rate of the earnings is constant at $g$, for simplicity. Then if there is no bubble,

$$P_t = \frac{E_t(1+g)}{k_e - g}. \tag{2}$$

Hence

$$\frac{P_t}{E_t} = \frac{(1+g)}{k_e - g}. \tag{3}$$

If the $P/E$ ratio is higher than resonable values of $g$ and $k_e$ suggest, then this equation is likely to be violated because of a bublle.

In the U.S., the $P/E$ ratio was about 21 in August 1987 before the October 1987 stock market crash and about 12 in 1989. In Japan, the $P/E$ ratio has been historically higher than that in the U.S. The $P/E$ ratio was about 21 in 1981, 35 in 1981, 71 in 1989, and 38 in 1991.