The Stock Market, the Theory of Rational Expectations and the Efficient Market Hypothesis

Money and Banking

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Revisiting risk premium

Program

ReCap

The stock market: recent trends
The valuation of stocks
How the market sets stock prices
The theory of rational expectations
The efficient market hypothesis
Suppose that when you turned 1y/o your wealthy uncle gave you a birthday present: a $2,500 investment in the NYSE. How much would you have today?

(a) $1,544
(b) $3,000
(c) $5,567
(d) $9,416

Correct answer: $9,416
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The stock market recent trends: S&P 500 1990-2011

Graph showing the S&P 500 index from 1990 to 2011, with key dates marked: 2-Jan-90, 2-Jan-92, 2-Jan-94, 2-Jan-96, 2-Jan-98, 2-Jan-00, 2-Jan-02, 2-Jan-04, 2-Jan-06, 2-Jan-08, 2-Jan-10. The graph highlights significant increases and decreases, with a peak of +225% and a dip of -25%.
The valuation of stocks

- First some terminology

\[ PV = CF \left(1 + \frac{i}{n}\right) \]

Where:
- \( PV \) = price of stock today
- \( CF \) = dividends and/or sales price
- \( i \) = return of your investment
- \( n \) = periods you hold the stock
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Or, we can generalize this framework as:

$$P_0 = \frac{D_1}{1 + k_e} + \frac{D_2}{(1 + k_e)^2} + \ldots + \frac{D_n}{(1 + k_e)^n} + \frac{P_n}{(1 + k_e)^n}$$

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The valuation of stocks: generalized dividend model

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If you hold the stock forever the last term will not be there. Of course you cannot hold it forever forever. But if the selling period is far enough in the future, we know that:

$$\lim_{n \to \infty} \frac{P_1}{(1 + k_e)^n} = 0 \quad \text{w/e} \quad (1 + k_e) > 1$$
So that we can ignore the last term and end up with:

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- But even if we knew \(D_t\) for all \(t\), this is an infinite sum with no common term (can’t use geometric series). So...
Simplifying assumption: dividends grow at a constant rate, $g$. So, if $D_0$ is the most recent dividend paid, equation (1) can be written:

$$P_0 = D_0 \frac{1 + g}{1 + k_e} + D_0 \frac{(1 + g)^2}{(1 + k_e)^2} + \ldots + D_0 \frac{(1 + g)^{\infty}}{(1 + k_e)^{\infty}}$$

And if we assume that $k_e > g$ we can rewrite as:

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- An electronic auction.

Note: the price is set by the buyer willing to pay the highest price. BUT: it is not necessarily the highest price this buyer would pay. Therefore, the asset goes to whoever values it more. Thus, valuation is key; information and accurate estimates about $D$ (or $g$) are critical. Also, $k$ is crucial; investors requiring high $k$ will have lower bids (they may dislike risk more than others).
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Suppose that the Fed were to increase the money supply or reduce interest rates (recall our analysis of the money market).

So that if you currently hold stocks, you are very happy!

So now you’re even happier!

Naturally this last effect is subject to the caveats we discussed before (recall Keynes vs Friedman).
How the market sets stock prices: monetary policy and stocks

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$$x_t^e = (1 - \rho) \sum_{j=0}^{\infty} \rho^j x_{t-j}$$

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Example

Suppose that you are back in Sep. 2007. You want to know if it is a good idea to buy stocks issued by Lehman Bros. If you were a ’adaptive’ expectations person you would predict something like an annual growth of xx% for the company in the coming years (2008-). However, if you form your expectations rationally, you would consider the additional information available to you; a major shock just hit US financial markets through the default of many 'subprime” mortgages. Not only the financial institutions that lent the money are in trouble, but also those who bought large amounts of 'securitized’ debt obligations (CDOs, MDOs) including your target company, Lehman Bros. Thus, if you behave ’rationally’, your future expectations about $g$ will be dramatically different than if you behave ’adaptively’
Rational expectations are used in all areas of decision making.
Rational expectations and the efficient market hypothesis

- Rational expectations are used in all areas of decision making.
- When applied to financial markets, the result is the efficient markets hypothesis:

\[ \text{Theorem (efficient markets hypothesis)} \]

In an efficient market, a security's current price reflects all currently available information.

Recall our formula for obtaining the rate of return from \( t \) to \( t+1 \):

\[ R = \frac{CF_t}{P_t} \sqrt[2]{\frac{P_{t+1}}{P_t}} \]

Where:
- \( CF_t \) is the cash payment \( t \)th.
- \( P_t \) is the price at time \( t \).
- \( P_{t+1} \) is the price at time \( t+1 \).

Suppose that \( CF_t \) and \( P_{t+1} \) are uncertain, then applying the rational expectations theory:

\[ R_e = \frac{\text{CF of } t}{\text{of } t + \text{of } P_{t+1}} \]

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R^e = R^{of} = \frac{CF^{of}}{P_t} + \frac{P^{of}_{t+1} - P_t}{P_t}
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But can we observe $R^e$? This is based on the expectations of each market participant...

Does the EMH make sense? Consider arbitrage: unexploited profit opportunities. Suppose that for some asset $R^e < R^{of}$, so that you (and probably everyone else) predict that in the future that investment on such asset will yield a higher return than the current equilibrium return. Then you (and probably many more) will buy such asset driving up its price so, the expected return on this asset falls until again $R^e = R^{of}$.

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Market fundamentals: items that have a direct impact on future income streams of the underlying security.
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Did the Nasdaq free fall from 5,000 points in 2000 to 1,500 points in 2001 reflect a dramatic change in market fundamentals?
Beyond the EMH: bubbles and behavioral finance

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Beyond the EMH: bubbles and behavioral finance

- It’s hard to explain some episodes of swings in stock prices only by changes in "fundamentals".
- Variables other than fundamentals may influence stock prices: psychological issues and the institutional structure of the marketplace.
- Rational bubbles.
- Irrational exhuberance: overconfidence and social contagion.