CHAPTER 11: THE EFFICIENT MARKET HYPOTHESIS

PROBLEM SETS

1. The correlation coefficient between stock returns for two non-overlapping periods should be zero. If not, one could use returns from one period to predict returns in later periods and make abnormal profits.

2. No. Microsoft's continuing profitability does not imply that stock market investors who purchased Microsoft shares after its success was already evident would have earned an exceptionally high return on their investments.

3. Expected rates of return differ because of differential risk premiums.

4. No. The value of dividend predictability would be already reflected in the stock price.

5. No, markets can be efficient even if some investors earn returns above the market average. Consider the Lucky Event issue: Ignoring transaction costs, about 50% of professional investors, by definition, will "beat" the market in any given year. The probability of beating it three years in a row, though small, is not insignificant. Beating the market in the past does not predict future success as three years of returns make up too small a sample on which to base correlation let alone causation.

6. Volatile stock prices could reflect volatile underlying economic conditions as large amounts of information being incorporated into the price will cause variability in stock price. The Efficient Market Hypothesis suggests that investors cannot earn excess risk-adjusted rewards. The variability of the stock price is thus reflected in the expected returns as returns and risk are positively correlated.

7. The following effects seem to suggest predictability within equity markets and thus disprove the Efficient Market Hypothesis. However, consider the following:

   a. Multiple studies suggest that "value" stocks (measured often by low P/E multiples) earn higher returns over time than "growth" stocks (high P/E multiples). This could suggest a strategy for earning higher returns over time. However, another rational argument may be that traditional forms of CAPM (such as Sharpe's model) do not fully account for all risk factors which affect a firm's price level. A firm viewed as riskier may have a lower price and thus P/E multiple.

b. The book-to-market effect suggests that an investor can earn excess returns by investing in companies with high book value (the value of a firm's assets minus its liabilities divided by the number of shares outstanding) to market value. A study by Fama and French[1] suggests that book-to-market value reflects a risk factor that is not accounted for by traditional one variable CAPM. For example, companies experiencing financial distress see the ratio of book to market value increase. Thus a more complex CAPM which includes book-to-market value as an explanatory variable should be used to test market anomalies.

c. Stock price momentum can be positively correlated with past performance (short to intermediate horizon) or negatively correlated (long horizon). Historical data seem to imply statistical significance to these patterns. Explanations for this include a bandwagon effect or the behavioralists' (see Chapter 12) explanation that there is a tendency for investors to underreact to new information, thus producing a positive serial correlation. However, statistical significance does not imply economic significance. Several studies which included transaction costs in the momentum models discovered that momentum traders tended to not outperform the Efficient Market Hypothesis strategy of buy and hold.

d. The small-firm effect states that smaller firms produce better returns than larger firms. Since 1926 returns from small firms outpace large firm stock returns by about 1% per year. Do small cap investors earn excess risk-adjusted returns?

The measure of systematic risk according to Sharpe's CAPM is the stock's beta (or sensitivity of returns of the stock to market returns). If the stock's beta is the best explanation of risk, then the small-firm effect does indicate an inefficient market. Dividing the market into deciles based on their betas shows an increasing relationship between betas and returns. Fama and French[2] show that the empirical relationship between beta and stock returns is flat over a fairly long horizon (1963-1990). Breaking the market into deciles based on sizes and then examining the relationship between beta and stock returns within each size decile exhibits this flat relationship. This implies that firm size may be a better measure of risk than beta and the size-effect should not be viewed as an indicator that markets are inefficient. Heuristically this makes sense, as smaller firms are generally viewed as risky compared to larger firms and perceived risk and return are positively correlated.

In addition this effect seems to be endpoint and data sensitive. For example, smaller stocks did not outperform larger stocks from the mid 1980s through the 1990s. In addition, databases contain stock returns from companies that have survived and do not include returns of those that went bankrupt. Thus small-firm data may exhibit survivorship bias.

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[1] Fama, Eugene and Kenneth French, "Common Risk Factors in the Returns on Stocks and Bonds," *Journal of Finance* 33:1, pp. 3-56.

[2] ibid

8. Over the long haul, there is an expected upward drift in stock prices based on their fair expected rates of return. The fair expected return over any single day is very small (e.g., 12% per year is only about 0.03% per day), so that on any day the price is virtually equally likely to rise or fall. Over longer periods, the small expected daily returns accumulate, and upward moves are more likely than downward ones.

9. c. This is a predictable pattern in returns which should not occur if the weak-form EMH is valid.

10. a. Acute market inefficiencies are temporary in nature and are more easily exploited than chronic inefficiencies. A temporary drop in a stock price due to a large sale would be more easily exploited than the chronic inefficiencies mentioned in the other responses.

11. c. This is a classic filter rule which should not produce superior returns in an efficient market.

12. b. This is the definition of an efficient market.

13. a. Though stock prices follow a random walk and intraday price changes do appear to be a random walk, over the long run there is compensation for bearing market risk and for the time value of money. Investing differs from a casino in that in the long-run, an investor is compensated for these risks, while a player at a casino faces less than fair-game odds.

    b. In an efficient market, any predictable future prospects of a company have already been priced into the current value of the stock. Thus, a stock share price can still follow a random walk.

    c. While the random nature of dart board selection seems to follow naturally from efficient markets, the role of rational portfolio management still exists. It exists to ensure a well-diversified portfolio, to assess the risk-tolerance of the investor and to take into account tax code issues.

14. d. In a semistrong-form efficient market, it is not possible to earn abnormally high profits by trading on publicly available information. Information about P/E ratios and recent price changes is publicly known. On the other hand, an investor who has advance knowledge of management improvements could earn abnormally high trading profits (unless the market is also strong-form efficient).

15. Market efficiency implies investors cannot earn excess risk-adjusted profits. If the stock price run-up occurs when only insiders know of the coming dividend increase, then it is a violation of strong-form efficiency. If the public also knows of the increase, then this violates semistrong-form efficiency.

16. While positive beta stocks respond well to favorable new information about the economy's progress through the business cycle, they should not show abnormal returns around already anticipated events. If a recovery, for example, is already anticipated, the actual recovery is not news. The stock price should already reflect the coming recovery.

17. a. Consistent. Based on pure luck, half of all managers should beat the market in any year.

    b. Inconsistent. This would be the basis of an "easy money" rule: simply invest with last year's best managers.

    c. Consistent. In contrast to predictable returns, predictable *volatility* does not convey a means to earn abnormal returns.

    d. Inconsistent. The abnormal performance ought to occur in January when earnings are announced.

    e. Inconsistent. Reversals offer a means to earn easy money: just buy last week's losers.

18. The return on the market is 8%. Therefore, the forecast monthly return for Ford is:

    $0.10\% + (1.1 \times 8\%) = 8.9\%$

    Ford's actual return was 7%, so the abnormal return was –1.9%.

19. a. Based on broad market trends, the CAPM indicates that AmbChaser stock should have increased by: $1.0\% + 2.0 \times (1.5\% - 1.0\%) = 2.0\%$
    Its firm-specific (nonsystematic) return due to the lawsuit is \$1 million per \$100 million initial equity, or 1%. Therefore, the total return should be 3%. (It is assumed here that the outcome of the lawsuit had a zero expected value.)

    b. If the settlement was expected to be \$2 million, then the actual settlement was a "\$1 million disappointment," and so the firm-specific return would be –1%, for a total return of 2% – 1% = 1%.

20. Given market performance, predicted returns on the two stocks would be:

    Apex: $0.2\% + (1.4 \times 3\%) = 4.4\%$

    Bpex: $-0.1\% + (0.6 \times 3\%) = 1.7\%$

    Apex underperformed this prediction; Bpex outperformed the prediction. We conclude that Bpex won the lawsuit.

21. a. $E(r_M) = 12\%$, $r_f = 4\%$ and $\beta = 0.5$

    Therefore, the expected rate of return is:

    $$4\% + 0.5 \times (12\% - 4\%) = 8\%$$

    If the stock is fairly priced, then $E(r) = 8\%$.

    b. If r_M falls short of your expectation by 2% (that is, 10% – 12%) then you would expect the return for Changing Fortunes Industries to fall short of your original expectation by: $\beta \times 2\% = 1\%$
    Therefore, you would forecast a "revised" expectation for Changing Fortunes of: 8% – 1% = 7%

    c. Given a market return of 10%, you would forecast a return for Changing Fortunes of 7%. The actual return is 10%. Therefore, the surprise due to firm-specific factors is 10% – 7% = 3% which we attribute to the settlement. Because the firm is initially worth $100 million, the surprise amount of the settlement is 3% of $100 million, or $3 million, implying that the prior expectation for the settlement was only $2 million.

22. Implicit in the dollar-cost averaging strategy is the notion that stock prices fluctuate around a "normal" level. Otherwise, there is no meaning to statements such as: "when the price is high." How do we know, for example, whether a price of $25 today will turn out to be viewed as high or low compared to the stock price six months from now?

23. The market responds positively to *new* news. If the eventual recovery is anticipated, then the recovery is already reflected in stock prices. Only a better-than-expected recovery should affect stock prices.

24. Buy. In your view, the firm is not as bad as everyone else believes it to be. Therefore, you view the firm as undervalued by the market. You are less pessimistic about the firm's prospects than the beliefs built into the stock price.

25. Here we need a two-factor model relating Ford's return to those of both the broad market and the auto industry. If we call r_I the industry return, then we would first estimate parameters $\alpha, \beta_M, \beta_{IND}$ in the following regression:

$$r_{FORD} = \alpha + \beta_M r_M + \beta_{IND} r_{IND} + \varepsilon$$

Given these estimates we would calculate Ford's firm-specific return as:

$$r_{FORD} - [\alpha + \beta_M r_M + \beta_{IND} r_{IND} + \varepsilon]$$

This estimate of firm-specific news would measure the market's assessment of the potential profitability of Ford's new model.

26. The market may have anticipated even greater earnings. *Compared to prior expectations,* the announcement was a disappointment.

27. Thinly traded stocks will not have a considerable amount of market research performed on the companies they represent. This neglected-firm effect implies a greater degree of uncertainty with respect to smaller companies. Thus positive CAPM alphas among thinly traded stocks do not necessarily violate the efficient market hypothesis since these higher alphas are actually risk premia, not market inefficiencies.

28. The negative abnormal returns (downward drift in CAR) just prior to stock purchases suggest that insiders deferred their purchases until *after* bad news was released to the public. This is evidence of valuable inside information. The positive abnormal returns after purchase suggest insider purchases in anticipation of good news. The analysis is symmetric for insider sales.

29. a. The market risk premium moves countercyclical to the economy, peaking in recessions. A violation of the Efficient Market Hypothesis would imply that investors could take advantage of this predictability and earn excess risk adjusted returns. However, several studies, including Siegel[3], show that successfully timing the changes have eluded professional investors thus far. Moreover a changing risk premium implies changing required rates of return for stocks rather than an inefficiency with the market.

b. As the market risk premium increases during a recession, stocks prices tend to fall. As the economy recovers, the market risk premium falls, and stock prices tend to rise. These changes could give investors the impression that markets overreact,

[3] Siegel, Jeremy, *Stocks for the Long Run: The Definitive Guide to Financial Market Returns and Long-Term Investment Strategies*, 2002, New York: McGraw-Hill.

especially if the underlying changes in the market risk premium are small but cumulative.

For example, the October Crash of 1987 is commonly viewed as an example of market overreaction. However, in the weeks running up to mid-October, several underlying changes to the market risk premium occurred (in addition to changes in the yields on long-term Treasury Bonds). Congress threatened investors with a "merger tax" that would have truncated the booming merger industry and loosened the discipline that the threat of mergers provides to a firm's management. In addition, the Secretary of Treasury threatened further depreciation in the value of the dollar, frightening foreign investors. These events may have increased the market risk premium and lowered stock prices in a seeming "overreaction."

CFA PROBLEMS

1. b. Semi-strong form efficiency implies that market prices reflect all *publicly available* information concerning past trading history as well as fundamental aspects of the firm.

2. a. The full price adjustment should occur just as the news about the dividend becomes publicly available.

3. d. If low P/E stocks tend to have positive abnormal returns, this would represent an unexploited profit opportunity that would provide evidence that investors are not using all available information to make profitable investments.

4. c. In an efficient market, no securities are consistently overpriced or underpriced. While some securities will turn out after any investment period to have provided positive alphas (i.e., risk-adjusted abnormal returns) and some negative alphas, these past returns are not predictive of future returns.

5. c. A random walk implies that stock price changes are unpredictable, using past price changes or any other data.

6. d. A gradual adjustment to fundamental values would allow for the use of strategies based on past price movements in order to generate abnormal profits.

7. a.

8. a. Some empirical evidence that supports the EMH:
   (i) professional money managers do not typically earn higher returns than comparable risk, passive index strategies;

(ii) event studies typically show that stocks respond immediately to the public release of relevant news;

(iii) most tests of technical analysis find that it is difficult to identify price trends that can be exploited to earn superior risk-adjusted investment returns.

b. Some evidence that is difficult to reconcile with the EMH concerns simple portfolio strategies that apparently would have provided high risk-adjusted returns in the past. Some examples of portfolios with attractive historical returns:

(i) low P/E stocks;

(ii) high book-to-market ratio stocks;

(iii) small firms in January;

(iv) firms with very poor stock price performance in the last few months.

Other evidence concerns post-earnings-announcement stock price drift and intermediate-term price momentum.

c. An investor might choose not to index even if markets are efficient because he or she may want to tailor a portfolio to specific tax considerations or to specific risk management issues, for example, the need to hedge (or at least not add to) exposure to a particular source of risk (e.g., industry exposure).

9. a. The efficient market hypothesis (EMH) states that a market is efficient if security prices immediately and fully reflect all available relevant information. If the market fully reflects information, the knowledge of that information would not allow an investor to profit from the information because stock prices already incorporate the information.

i. The *weak form* of the EMH asserts that stock prices reflect all the information that can be derived by examining market trading data such as the history of past prices and trading volume.

A strong body of evidence supports weak-form efficiency in the major U.S. securities markets. For example, test results suggest that technical trading rules do not produce superior returns after adjusting for transaction costs and taxes.

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ii. The *semistrong form* states that a firm's stock price reflects all publicly available information about a firm's prospects. Examples of publicly available information are company annual reports and investment advisory data.

Evidence strongly supports the notion of semistrong efficiency, but occasional studies (e.g., identifying market anomalies such as the small-firm-in-January or book-to-market effects) and events (e.g. stock market crash of October 19, 1987) are inconsistent with this form of market efficiency. There is a question concerning the extent to which these "anomalies" result from data mining.

iii. The *strong form* of the EMH holds that current market prices reflect *all* information (whether publicly available or privately held) that can be relevant to the valuation of the firm.

Empirical evidence suggests that strong-form efficiency does not hold. If this form were correct, prices would fully reflect all information. Therefore even insiders could not earn excess returns. But the evidence is that corporate officers do have access to pertinent information long enough before public release to enable them to profit from trading on this information.

b. i. *Technical analysis* involves the search for recurrent and predictable patterns in stock prices in order to enhance returns. The EMH implies that technical analysis is without value. If past prices contain no useful information for predicting future prices, there is no point in following any technical trading rule.

ii. *Fundamental analysis* uses earnings and dividend prospects of the firm, expectations of future interest rates, and risk evaluation of the firm to determine proper stock prices. The EMH predicts that most fundamental analysis is doomed to failure. According to semistrong-form efficiency, no investor can earn excess returns from trading rules based on publicly available information. Only analysts with unique insight achieve superior returns.

In summary, the EMH holds that the market appears to adjust so quickly to information about both individual stocks and the economy as a whole that no technique of selecting a portfolio using either technical or fundamental analysis can consistently outperform a strategy of simply buying and holding a diversified portfolio of securities, such as those comprising the popular market indexes.

c. Portfolio managers have several roles and responsibilities even in perfectly efficient markets. The most important responsibility is to identify the risk/return objectives for a portfolio given the investor's constraints. In an efficient market, portfolio managers are responsible for tailoring the portfolio to meet the investor's needs, rather than to beat the market, which requires identifying the client's return requirements and risk tolerance. Rational portfolio management also requires examining the investor's constraints, including liquidity, time horizon, laws and regulations, taxes, and unique preferences and circumstances such as age and employment.

10. a. The earnings (and dividend) growth rate of growth stocks may be consistently overestimated by investors. Investors may extrapolate recent growth too far into the future and thereby downplay the inevitable slowdown. At any given time, growth stocks are likely to revert to (lower) mean returns and value stocks are likely to revert to (higher) mean returns, often over an extended future time horizon.

b. In efficient markets, the current prices of stocks already reflect all known relevant information. In this situation, growth stocks and value stocks provide the same risk-adjusted expected return.