

UNIVERSITY OF PENNSYLVANIA
The Wharton School

FNCE 100

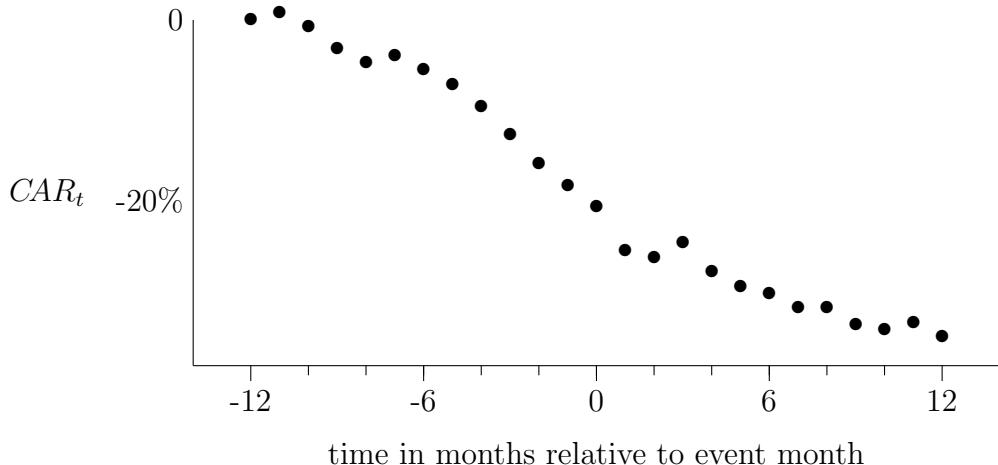
A. Craig MacKinlay
PROBLEM SET #5

Fall Term 2005

MARKET EFFICIENCY

1. Money manager Robert J. Betaman of Betaman-Rubin Associates has shown an uncanny ability to beat the market (i.e., to earn consistently abnormally high returns after adjustments for risk, transactions costs, etc.). Until recently, other investors' attempts to learn Betaman's secrets have failed totally. However, one year ago, Betaman revealed his secret formula for investment success in an interview published in the business section of *The National Enquirer*. Over the last year, Betaman has not earned abnormally high returns using his formula. Briefly explain why.

2.



The above diagram represents the (hypothetical) results of a study of the behavior of stock prices of firms that lost antitrust cases. (Included are all firms that lost the initial court decision, even if the ruling was later overturned on appeal.) Is the diagram consistent with market efficiency? Why or why not?

3. Consider an efficient capital market. If a particular economic variable which influences a firm's profits is predictable, would you expect price changes in the stock to be predictable?

4. "If the Efficient Market Hypothesis is true, the pension fund manager might as well select a portfolio with the financial pages of the WSJ, a thumbtack, a wall and a dart." Explain why this is not so.

5. Fama-Fisher-Jensen-Roll's observation that, on the average, firms which split their stock earn abnormal returns prior to the split announcement:

- (a) is evidence in favor of the semi-strong form of the efficient market hypothesis (SSF-EMH);
- (b) is evidence against the SSF-EMH;
- (c) neither supports nor refutes the SSF-EMH;
- (d) is evidence that firms which split their stock have done well in the period prior to the split announcement;
- (e) (a) and (d);
- (f) (b) and (d);
- (g) (c) and (d);
- (h) none of the above.

Select one. Explain.

6. A respected security analyst has analyzed annual reports and 10-K reports in detail and adjusted firms' liabilities to reflect unfunded pension benefits. He has found that this adjustment would drastically affect the book value of equity for some corporations. On the day that he publicly reported his results, the stock prices of the corporations for which he labeled the reported book value as "substantially overstated" did not have price changes which could not be explained by market movements, however. Furthermore, in the month after the announcement, on average there were no statistically significant abnormal returns for these companies, once the returns were adjusted for risk. This sequence of events is evidence supporting:

- (a) strong-form efficiency;
- (b) semi-strong-form efficiency but neither supporting nor refuting strong form efficiency;
- (c) weak-form efficiency but neither supporting nor refuting semistrong-form efficiency;
- (d) informational inefficiency at the weak-form level.

7. A business journalist recently argued that "well-managed firms aren't necessarily more profitable than those with average management." He examined the rates of return earned by stockholders in a group of 25 firms cited in 1978 as "especially well-managed", and found that the average return on their stocks from 1978 to 1981 almost exactly matched the return on the New York Stock Exchange Index for the same period. "If well-managed firms were really more profitable, stockholders' returns would have been superior," he argued.

Do you agree with his conclusion? Explain briefly. (Assume that everyone agreed that these 25 firms had superior management.)

8. (a) Suppose the stock market is efficient in the semi-strong sense, but strong form inefficient. Can you earn returns on Chrysler stock beyond those forecast by the risk-return tradeoff of the CAPM if you buy it based on:

- your broker's information that Chrysler has had record earnings this year? If so, why?
- rumors that Chrysler may be purchased by General Motors? If so, why?
- yesterday's announcement that Chrysler has discovered a new improved engine technology? If so, why?

(b) You set out to test whether the market's response to this last announcement—the engine breakthrough—is consistent with semistrong form efficiency. Chrysler's stock, and the market as a whole, have risen since the announcement. Can you suggest a test of efficiency using the capital asset pricing model?

9. January 10, 1985. Early today the Justice Department reached a decision in the Universal Product Care case. UPC has been found guilty of discriminatory practices in hiring. For the next five years, UPC must pay \$2,000,000 each year to a fund representing the victims of UPC's policies. True or false: investors should not buy UPC stock after the announcement since the litigation will cause an abnormally low rate of return. Explain.

10. You are doing a cumulative average residual study looking at the share price impact of food companies announcing the closing of unprofitable super markets. You have the following data:

A&P			Krogers			Kohls		
date	stock return	market return	date	stock return	market return	date	stock return	market return
5-11	-1.0%	-0.5%	2-6	+1.2%	+1.8%	3-13	+1.0%	-0.4%
5-12	+0.3	+0.2	2-7	+0.6	+0.7	3-14	+0.2	+0.5
5-13	+0.1	+1.2	2-8	-0.5	-0.9	3-15	-1.5	-1.6
5-14	+0.6	-0.3	2-9	-0.3	-0.7	3-16	+0.8	+1.2
5-17	+5.0	+1.1	2-10	+8.2	+0.1	3-19	+4.0	-0.4
5-18	+1.1	+1.1	2-13	-1.2	-0.3	3-20	+0.5	-0.1
5-19	+0.1	-0.3	2-14	-1.3	-0.6	3-21	-1.2	-1.2
5-20	-0.9	-1.5	2-15	-0.1	+0.7	3-22	+0.5	+0.9
5-21	-0.3	+0.2	2-16	-0.1	-0.9	3-23	-1.3	-1.0

All three companies have stock betas of 1.0. A&P announced its supermarket closings on Saturday, May 15. Kroger announced its supermarket closings Thursday evening, February 9. Kohls announced its supermarket closings on Sunday, March 18. Construct a cumulative average residual diagram for the event of announcing supermarket closings. Interpret your diagram.

UNIVERSITY OF PENNSYLVANIA
The Wharton School

FNCE 100

Solutions to PROBLEM SET #5

A. Craig MacKinlay

Fall Term 2005

MARKET EFFICIENCY

1. The formula self-destructed as soon as it became public knowledge. Competition among investors drives prices up or down so that only competitive levels of expected return will be earned.
2. T(-12) to T(-1): Market efficiency cannot be rejected by average excess returns in this range; prices fall abnormally as it becomes increasingly obvious that the firm will lose the decision. T(0): Market efficiency again cannot be rejected since price will fall as the court decision becomes certain. In the range T(1) to T(12) efficiency may be rejected. The price fall at time 0 should provide an unbiased estimate of true value. The fact that the connected dots generally exhibit a downward slope indicates that the first estimate was not a good one and that investors could earn superior returns with public information. They could sell companies that lost such decisions short and invest the proceeds in companies of a similar risk class. In the long-run this would provide superior returns.
3. No, investors with knowledge of this predictability will price the securities so that it will reflect all information about the firm's future profits. When this is done, the expected return on the stock will be independent of previous changes in the stock price.
4. First, the resulting portfolio might not be well-diversified (the darts might land on the same or highly correlated stocks) thus leaving the fund with unique risk (which will not be rewarded). Second, the resulting portfolio might have too much systematic risk for the individuals. If individuals have additional wealth that they can invest in riskless assets, then this is not a problem, but if not, the portfolio might offer too high a beta, given the individual's risk preferences. A further consideration in our "non-perfect" world is the presence of taxes. The tax position of investors is of a critical nature. Because of the equilibrating process certain assets earn surpluses because of their high taxability. The after-tax return on these assets to individuals in low brackets is favorable. This consideration also makes tax status an important variable.
5. g. (c) and (d) are both correct. The fact that on average, firms which split their stock earn abnormal returns prior to the split announcement, can be explained by their good

performance. That is, firms that have done well, often split their shares. We cannot reject the hypothesis of an efficient market, nor can we accept it.

6. b. 10-K reports are part of the public information domain; semi-strong form efficiency is at stake, not strong-form since the information is generally available. Semi-strong efficiency is supported since we are unable to earn excess returns from the 10-K reports.
7. This question raises two issues: efficiency and risk adjustment.
 - (a) The main point is that one must draw a distinction between profitability of a corporation and the ability to earn an excess return on that corporation's stock. If investors know which firms are well-managed, stockholders will bid up the prices of these shares until the expected return on these securities is the same as that on the shares of poorly managed firms, correcting for differences among firms in systematic risk.
 - (b) A peripheral point is that the returns on the well-managed firms may in fact have been superior even though these matched the NYSE index. If the average β of shares of the well-managed firms was less than 1, but these shares matched the index, investors earned an excess return when adjusted for risk.
8. (a) i. No. The information that Chrysler has had a record year is certainly public, since it has by definition been publicized over the whole year. If the market is semi-strong form efficient, all public information is incorporated into the share price already.
 - ii. It depends on whether the rumors you hear are based on "inside" or public information. If a mergers and acquisitions specialist who is working on a Chrysler-GM deal lets you know of an impending announcement, it is likely you could profit from the news. It would also, however, be unambiguously illegal to do so. However, if the rumors are published in the financial press, profiting from them is impossible if the market is efficient in the semi-strong sense.
 - iii. No. If the market is efficient with respect to public information, then by the time you attempt to profit based on this announcement it will be too late.
- (b) We want to devise a test which highlights any excess returns on Chrysler beginning a day or so after the announcement. By excess returns we mean returns beyond those forecast by some model's prediction of how much Chrysler is expected to yield. With the CAPM the forecast return, given the ex-post return on the market, is:

$$E(r_{\text{chrys},t} | r_{m,t}) = r_f + \beta_{\text{chrys}}(r_{m,t} - r_f)$$

where $r_{m,t}$ is the actual ex-post (daily) return on the market. Thus, if the market has risen and $\beta_{\text{chrys}} > 0$, we would forecast that Chrysler's shares should have risen also. The question is, has the actual return on Chrysler exceeded this

forecasted return. A sensible test is to add up the differences between the actual daily returns and those forecasted by the CAPM, thus constructing a “cumulative average residual.” We would then investigate whether the cumulative residual rose before, during, or after the event day. If news had not leaked out ahead of time, we would expect to see the CAR be constant up until the announcement and then jump up on the announcement day. If markets are efficient, we would expect the CAR to be flat after the announcement.

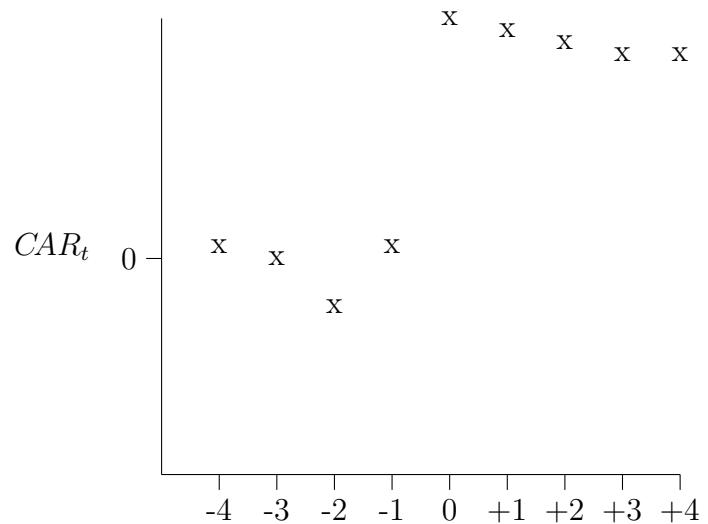
The problem with doing an event study in this case is that we only have one stock (i.e. we are not really examining a cumulative *average* residual, because we are not averaging over a number of different stocks). If we observe the CAR continuing to rise after the event date, we cannot really tell whether it is a sign of market inefficiency or it just happened that in this case the good news was followed by the announcement of additional good news for Chrysler.

9. False. In an efficient market (semi-strong form), the price of UPC stock will adjust to reflect the liability. Thus, investors buying in can expect to earn a competitive expected rate of return.
10. $r_{jt} = r_f + \beta_j(r_{mt} - r_f) + \epsilon_{jt} = r_f(1 - \beta_j) + \beta_j r_{mt} + \epsilon_{jt}$

In this case, $\beta_j = 1$, so $r_{jt} = r_{mt} + \epsilon_{jt}$

$$\epsilon_{jt} = r_{jt} - r_{mt}$$

Event date	\sum^3 Abnormal returns	$1/3 \sum^3$ Abnormal returns	cumulative average residual
-4	+0.3	+0.1	+0.1
-3	-0.3	-0.1	0
-2	-0.6	-0.2	-0.2
-1	+0.9	+0.3	+0.1
0	+16.4	+5.5	+5.6
+1	-0.3	-0.1	+5.5
+2	-0.3	-0.1	+5.4
+3	-0.6	-0.2	+5.2
+4	0	0	+5.2



The cumulative average residuals show that the stock market reacts favorably, on average, to the announcement of supermarket closings for the companies involved, with the stock increasing an average of about 5 1/2 percent. There doesn't seem to be any noticeable trend before or after the announcement, which is consistent with efficiency.