

## On the Contrarian Investment Strategy\*

### I. Introduction

A contrarian stock selection strategy consists of buying stocks that have been losers and selling short stocks that have been winners. Preached by market practitioners for years, it is still in vogue on Wall Street and La Salle Street. The strategy is formulated on the premise that the stock market overreacts to news, so winners tend to be overvalued and losers undervalued; an investor who exploits this inefficiency gains when stock prices revert to fundamental values. Many investment strategies, such as those based on the price/earnings ratio, or the book/market ratio, can be regarded as variants of this strategy.<sup>1</sup>

The contrarian strategy has many critics in academe, for any trading rule based on past prices violates the weakest form of market efficiency hypothesized by finance theorists. However, the recent resurgence of the academic debate on market efficiency and the theory of

Recent research found an abnormal return on the strategy of buying losers and selling winners in the stock market, a finding sometimes interpreted as support for the market overreaction hypothesis. This article explores an alternative interpretation of this evidence. We find that the risks of losers and winners are not constant. The estimation of the return of this strategy is, therefore, sensitive to the methods used. When risk changes are controlled for, we find only small abnormal returns. The model of risk and return used in the paper is the standard Capital Asset Pricing Model.

\* Some results in this paper appeared earlier in ch. 1 of my University of Chicago Ph.D. dissertation, "Market Value Changes and Time-varying Risk" (1985). I thank Nai-fu Chen, my committee chairman, for guidance, Merton Miller for discussion, and Werner De Bondt for comments on an earlier draft. I also thank my discussant, Don Panton, and participants at the 1987 Western Finance Association annual meeting in San Diego for comments. All errors are my own. This research has been supported by an Ohio State University seed grant.

1. The price/earnings ratio and the book/market ratio are correlated with cumulative past returns. See De Bondt and Thaler (1987).

(*Journal of Business*, 1988, vol. 61, no. 2)

© 1988 by The University of Chicago. All rights reserved.

0021-9398/88/6102-0001\$01.50

nonrational behavior has given the contrarian investment strategy a new respectability.<sup>2</sup>

A study in experimental psychology by Kahneman and Tversky (1982) finds that people tend to overreact to unexpected and dramatic events. Applying this result to the stock market, De Bondt and Thaler (1985) report that, on the basis of the past half century of data, large abnormal returns can be earned by the contrarian investment strategy. The two authors interpret this as support for the market-overreaction hypothesis. In his review of the current debate on market efficiency, Merton (1985) considers the work of De Bondt and Thaler to be "particularly noteworthy because it represents a first attempt at a formal test of cognitive misperceptions theories as applied to the general stock market."<sup>3</sup>

This article offers an alternative interpretation of the evidence on the performance of the contrarian strategy. We propose that the risks of winner and loser stocks are not constant over time. The risk of the strategy appears to correlate with the level of expected market-risk premium. The estimation of abnormal returns may, therefore, be sensitive to how the risks are estimated. Second, there are measurement errors in the betas estimated from the period during which losers and winners are sorted. The model of risk and return we adopt is the standard Sharpe-Lintner Capital Asset Pricing Model (CAPM). Our approach differs from Fama and French (1986) in that they explain the reversal effect by means of the size effect.

The rest of the article is organized as follows: in Section II, the samples are discussed. One sample is constructed using the procedure reported by De Bondt and Thaler (1985), while the other contains more stocks. In Section III, we present the test for abnormal returns and discuss the nonstationarity nature of the betas. We find no evidence of excess returns from the contrarian strategy. Section IV explores the correlation between the betas and the market-risk premium. We propose that the time variations of the betas and the risk premium are related to changes in the real activity. The last section is the conclusion.

## II. Description of the Samples

### *Portfolios Construction*

De Bondt and Thaler (1985) conduct their test on different samples of winning and losing stocks. Maximum annual performance is found when winners and losers are measured by performance in the previous 3 years. The 3-year samples are described in detail in that article, so

2. See Merton (1985) for a review of the literature.

3. *Ibid.*, p. 23.

similar portfolios are constructed for this study. Returns over the recent 3 years are used to identify winners and losers.<sup>4</sup> The samples are constructed every 3 years, at the end of each year, 1932, 1935, 1938, and so on, to 1983. In addition, De Bondt and Thaler require their sampled stocks to be listed in the 7-year period preceding the rank date—4 years more than needed—to ensure that the sample consists of established firms. When a stock is no longer available after portfolio formation, however, we drop it from the sample and rebalance the portfolio after the last return is incorporated. For instance, in the first sample, formed at the end of 1932, all stocks listed in the New York Stock Exchange in the previous 7 years (1926–32) are ranked according to their recent 3-year (1930–32) market-adjusted returns. The top 35 performers are put into the winner portfolio, and the bottom 35 stocks are put into the loser portfolio. We call the period 1930–32 the *rank period*. The performance of the winner and loser portfolios are tracked for the following 3 years, labeled here as the *test period*. As the Center for Research in Security Prices (CRSP) data end in 1985, the sample formed at the end of 1983 is only 2 years long. All together, 53 years or 636 months of nonoverlapping returns for the winner and loser portfolios are obtained.

We also collect another sample for this study.<sup>5</sup> The second sample differs from the first in the following respects: winners and losers are identified as the top and bottom deciles of stocks instead of the extreme 35. A decile contains about 70 stocks in 1933 and about 140 stocks in 1985. These samples will help us determine whether the De Bondt and Thaler finding holds for broader-based investment strategies. In addition, stocks are not required to be listed before their returns are needed to determine winners and losers. Stocks in the second sample are, therefore, less established than those in the first.

### *Size Characteristics*

Both winner and loser portfolios experience large changes in market value (number of shares  $\times$  share price) during the rank period. In the De Bondt and Thaler sample, the average value change of loser stocks is  $-45\%$ , and that of winner stocks is  $365\%$ . The changes in capitalization are so large that, although the median loser stock is bigger than the median winner at the beginning of most rank periods, it becomes smaller than the median winner at the end. This is documented in table 1.

If market value is a good proxy for risk, as suggested by the size-effect literature, the losers are safer in the beginning but become riskier

4. De Bondt and Thaler (1985) define their performance measures as the arithmetic sum of the market adjusted returns. I follow their procedure.

5. Other samples are also investigated but not reported by De Bondt and Thaler (1985).

**TABLE 1** Changes in Capitalization during the Rank Periods (1930–83)  
(De Bondt and Thaler Sample)

Portfolio Formation Month	Losers			Winners		
	Median Capitalization		Average Change (%)	Median Capitalization		Average Change (%)
	Beginning	End		Beginning	End	
12/32	22.95*	2.73*	–92	14.82	1.74	–48
12/35	22.25*	12.88*	–23	.33	2.91	138
12/38	5.29*	1.53	–69	3.50	8.02	180
12/41	3.49*	.51	–84	1.43	2.14	150
12/44	58.50*	55.30*	–1	.63	4.69	686
12/47	18.04*	11.49	11	6.61	23.26	224
12/50	11.44*	8.35	–36	6.38	18.93	160
12/53	5.70	2.25	–25	17.58	34.24	95
12/56	27.64*	15.29	–28	23.52	107.54	528
12/59	37.16*	15.89	–44	14.99	51.07	417
12/62	38.35*	19.79	–52	26.45	49.60	125
12/65	56.32*	36.68	–35	23.09	118.00	423
12/78	563.94*	427.56*	–24	26.71	174.68	589
12/71	95.40	23.24	–74	157.44	373.16	148
12/74	133.38*	13.39	–90	111.98	240.00	87
12/77	316.17*	211.69*	–32	15.63	69.61	335
12/80	120.87*	50.52	–47	41.89	383.38	642
12/83	636.22*	253.92	–53	56.19	352.55	446
Mean over rank periods			–45			365

NOTE.—Median capitalization is in millions of dollars.

\* The median loser stock value is bigger than the median winner stock value.

than winners by the end of the formation period. Stocks whose values diminish become more risky for many reasons. From option pricing theory, a change in the firm value has a bigger effect on the market value of equity than on the market value of debt and other debtlike liabilities of the firm. Thus, barring any offsetting actions taken by the firm, the financial leverage (on and off balance sheet) of the loser firm becomes bigger as the stock price falls, increasing the risk of the stock. The risk of the firm may also increase as the firm value falls because of the loss of economies of scale and increase in the operating leverage. This leverage effect reduces the risk of the winner stocks as their values increase during the rank period.

If we estimate a beta in the rank period, failing to model the changes in risk, the estimated beta will be a biased estimate of the beta in the test period. Since the risk of the loser portfolio increases during the rank period, the rank-period beta underestimates the test-period beta. For the winners, the bias is in the opposite direction.

The combination of the initial size characteristics and subsequent size changes explain why De Bondt and Thaler find that winners' betas computed with rank-period returns are larger than losers'. The two

authors argue that, since winners have larger betas than losers, their estimate of the reversal effect, with the assumption that winners and losers have equal beta, in effect underestimates the true reversal effect. But since the rank-period betas are misestimated, this claim may be incorrect. One must estimate the test-period betas directly to make the risk adjustment.

Since loser stocks are smaller than winners at the beginning of the test periods, the reversal effect may be related to the size effect, the well-known relation between average returns and market values.<sup>6</sup> Fama and French (1986) compare the returns of the De Bondt and Thaler winners and losers with returns of size-matched portfolios. Their results suggest that the size effect explains part, but only part, of the reversal effect.

### III. A Time-Series Test for Abnormal Returns

#### *Model*

Our test for abnormal returns is identical to the time-series test of the CAPM run by Black, Jensen, and Scholes (1972). We assume that expected returns are generated by the Sharpe-Lintner CAPM. With appropriate distributional assumptions, the following ordinary least squares (OLS) regression equation for asset  $i$  is well specified:

$$r_{it} - r_{ft} = \alpha_i + \beta_i(r_{mt} - r_{ft}) + \epsilon_{it}, \quad t = 1, \dots, T. \quad (1)$$

The equally weighted CRSP market index serves as our market portfolio  $r_m$ . Equation (1) is tested over the test period, in which the beta is assumed to be constant. We interpret the null hypothesis that asset  $i$  earns no abnormal return to mean that  $\alpha_i = 0$ .<sup>7</sup> This implies that we ignore any bias introduced by the size effect. If the size effect is significant in our sample, it will, however, bias against our null hypothesis of no abnormal returns, as the loser stocks are smaller than winners at the beginning of the test periods.

The OLS estimate of  $\alpha_i$  is centered around the true parameter, and its variance is given by

$$\hat{\sigma}^2(\hat{\alpha}_i) = (1/T) (1 + \bar{r}_m^T / s_{m'}^2) \hat{\sigma}_\epsilon^2,$$

where  $\bar{r}_m^T$  is the sample mean of the market return less the risk-free rate;  $s_{m'}^2$  is the sample variance of  $(r_{mt} - r_{ft})$  without an adjustment for degrees of freedom; and  $\hat{\sigma}_\epsilon^2$  is the sample variance of  $\epsilon_{it}$ . Assuming that  $\epsilon_{it}$  is normally distributed, under the null hypothesis the ratio of  $\hat{\alpha}_i$  to its

6. See, e.g., Banz (1981).

7. The performance evaluation is ambiguous if we do not know if the market index we use is ex ante efficient. See Roll (1977).

standard error,  $\hat{\sigma}(\hat{\alpha}_i)$ , is distributed as a student- $t$  with  $(T - 1)$  degrees of freedom.

Betas and abnormal returns are thus simultaneously estimated in the test periods. There are no errors in variables because we presume to know what market index to use, and the test is conditioned on that choice. The estimated intercept in equation (1) is consistent, and its standard error reflects the uncertainty of the estimated beta. This time-series test is well suited to our problem because there is no need to have a separate period for estimating the beta. We could go back to the rank period to estimate the beta, but to do it correctly, we would have to model the beta's time variation, a formidable task. However, going forward to use future data after the test period might violate the stationarity assumption and, worse, introduce survivorship bias.

The estimates of the regression parameters for the 1933–85 period are weighted averages of the parameters in individual test periods. The weights are proportional to the length of the test periods—the last period has 2 years while all others have 3. To aggregate the  $t$ -statistics, we make use of the fact that the test periods (each with  $T_i$  observations) are nonoverlapping. Under the null hypothesis, by the independence assumption and the central limit theorem, the following statistic based on  $t$  values from the test periods approaches a standard normal distribution,

$$U = \frac{1}{\sqrt{N}} \sum_{i=1}^N t_i \sqrt{(T_i - 3)/(T_i - 1)} \sim N(0, 1),$$

as the number of test periods,  $N$ , gets large. This will be our test statistic for the entire period.

#### *Performance and Risk in the Rank Period and the Test Period*

The basis of the contrarian strategy is that the rank-period abnormal return is followed by a reversal in the test period. By modifying the regression equation (1) slightly, we can examine the risk and performance in the rank period and the test period in a single equation. We are particularly interested in finding out whether the betas change from the rank period to the test period.

We run the following regression:

$$\begin{aligned} r_{it} - r_{ft} = & \alpha_{1i}(1 - D_t) + \alpha_{2i}D_t \\ & + \beta_i(r_{mt} - r_{ft}) + \beta_{iD}(r_{mt} - r_{ft})D_t + \epsilon_{it}, \end{aligned} \quad (2)$$

where  $t = 1$  to 72 (or 60, as in the 1983 sample),  $r_{mt}$  is the equally weighted CRSP index,  $r_{ft}$  is the risk-free rate; the dummy variable  $D_t$  is equal to zero in the preranking period ( $t \leq 36$ ) and to one in the test period ( $t > 36$ ), letting us estimate different intercepts and betas for the 2 periods. The mean abnormal return in the rank period is estimated by

$\hat{\alpha}_{1t}$  and that of the test period is estimated by  $\hat{\alpha}_{2t}$ . The rank-period beta is estimated by  $\hat{\beta}_i$  and the test-period beta is  $(\hat{\beta}_i + \hat{\beta}_{iD})$ . The rank-period beta may not be constant, but under certain independence assumptions the OLS estimate of  $\beta_i$  is the mean estimate for the moving beta. However, if the beta is constant throughout the rank and test periods,  $\hat{\beta}_{iD}$  should be indistinguishable from zero. We assume that  $\epsilon_{it}$  is normally distributed with a variance of  $\sigma_{11}^2$  in the rank period and  $\sigma_{22}^2$  in the test period, the two variances being not necessarily different. Due to our variance assumption, the estimated coefficients and standard errors of the  $\alpha$ 's are no different from what are obtained by running regression equation (1) in the rank period and the test period separately.

We run the regression equation (2) using as dependent variables the excess returns of the loser and winner portfolios and the return of a self-financed arbitrage portfolio (loser – winner), which consists of a long position on the losers and a short position on the winners. Regression estimates for the De Bondt and Thaler sample and the decile sample are reported separately in tables 2 and 3. The tables show that losers have large negative abnormal returns and that winners have large positive abnormal returns in the rank periods, ranging from 2.2% to 3.1% monthly in absolute magnitude, and that the arbitrage portfolio (losers – winners) loses 4.56% per month in the 3-year rank period in one sample and 5.87% in another.

*Small abnormal returns between losers and winners.* We observe only small abnormal returns to the contrarian strategy during the test period. Controlling for transaction costs, that is probably not economically significant. In table 2, the mean monthly abnormal returns are  $-.095\%$ ,  $-.228\%$ , and  $.133\%$  per month for the loser, winner, and arbitrage portfolios. The aggregate test statistic for the arbitrage portfolio excess return is .88, far below the standard normal value normally taken to suggest significant difference from zero. Only the winner portfolio's abnormal return may be interpreted to be reliably different from zero, using the usual probability value.

In the broader-based decile sample, in table 3, the mean is  $.032\%$  for the losers,  $-.236\%$  for the winners, and  $.269\%$  for the arbitrage portfolio per month. The arbitrage portfolio return is higher in this sample than the other sample. But in any case, the abnormal return of the arbitrage portfolio in either sample is neither large nor reliably different from zero.

*Risk changes from the rank to the test periods.* The estimated rank-period betas are smaller for losers and bigger for winners. This is not surprising as losers have larger capitalization than winners at the beginning of the rank period. Since the OLS rank-period beta is only some

TABLE 2      Testing for Abnormal Returns under the Assumption that the Rank-Period and Test-Period Betas Are Not Equal—  
the De Bondt and Thaler Sample

	Loser			Winner			Loser - Winner		
	$\hat{\alpha}_{1t}$	$\hat{\alpha}_{2t}$	$\hat{\beta}_t$	$\hat{\beta}_{1D}$	$\hat{\alpha}_{1t}$	$\hat{\alpha}_{2t}$	$\hat{\beta}_t$	$\hat{\beta}_{1D}$	$\hat{\beta}_{1D}$
1930-35	-.0343 (-6.44)	.0013 (.14)	.97 (32.50)	.27 (4.34)	.0566 (3.99)	.0025 (.22)	1.32 (16.62)	-.17 (-1.62)	-.35 (-4.42)
1933-38	-.0259 (-3.54)	-.0077 (-1.72)	.55 (12.59)	.43 (7.16)	.0254 (2.66)	-.0018 (-.43)	1.71 (29.97)	-.40 (-5.83)	-1.16 (-13.05)
1936-41	-.0316 (-7.85)	.0054 (.43)	.99 (27.09)	.64 (4.92)	.0387 (4.18)	-.0034 (-.55)	1.64 (19.65)	-.08 (-.80)	-.66 (-7.48)
1939-44	-.0390 (-4.15)	-.0008 (-.07)	1.07 (11.40)	1.26 (6.02)	.0471 (2.54)	-.0027 (-.51)	2.09 (11.36)	-.93 (-4.60)	-1.03 (-4.12)
1942-47	-.0122 (-2.90)	.0019 (1.13)	.50 (7.85)	.22 (3.09)	.0094 (.57)	-.0059 (-.91)	2.76 (11.12)	-1.31 (-4.79)	-2.26 (-7.67)
1945-50	-.0229 (-6.06)	.0002 (.04)	1.07 (16.16)	.32 (2.94)	.0250 (4.64)	.0021 (.91)	1.26 (13.40)	-.09 (-.90)	-.19 (-1.72)
1948-53	-.0213 (-6.55)	-.0048 (-1.65)	.96 (14.63)	.07 (.64)	.0233 (5.17)	-.0040 (-1.83)	1.17 (12.91)	.07 (.58)	-.21 (-1.58)
1951-56	-.0305 (-7.81)	-.0073 (-1.02)	1.08 (8.68)	.28 (1.21)	.0195 (9.06)	.0031 (1.10)	1.15 (16.68)	-.11 (-1.09)	-.07 (-1.40)
1954-59	-.0257 (-7.38)	.0039 (.92)	.94 (9.90)	.52 (3.44)	.0225 (5.33)	-.0085 (-2.43)	1.53 (13.21)	-.25 (-1.66)	-.58 (-3.41)



1957-62	-.0302 (-9.04)	-.0044 (-.92)	1.40 (15.40)	-.17 (-1.30)	.0329 (5.83)	-.0068 (-1.78)	1.34 (8.71)	.12 (.68)	-.0631 (-8.30)	.0024 (.32)	.06 (.31)	-.29 (-1.12)
1960-65	-.0259 (-7.92)	.0002 (.05)	1.23 (18.11)	.40 (2.52)	.0238 (8.36)	-.0001 (-.03)	1.17 (19.71)	-.22 (-2.40)	-.0498 (-10.81)	.0003 (.05)	.07 (.68)	.61 (3.22)
1963-68	-.0222 (-8.11)	.0018 (.46)	.91 (10.23)	.22 (1.82)	.0258 (4.89)	-.0093 (-1.57)	1.94 (11.34)	-.48 (-2.29)	-.0479 (-8.94)	.0111 (1.58)	-1.03 (-5.94)	.70 (3.09)
1966-71	-.0176 (-6.51)	.0012 (.40)	.73 (13.12)	.08 (1.07)	.0296 (4.65)	-.0038 (-.85)	1.61 (12.27)	-.18 (-1.23)	-.0472 (-5.72)	.0050 (.77)	-.88 (-5.17)	.26 (1.32)
1969-74	-.0307 (-6.21)	.0083 (.93)	1.39 (17.37)	-.11 (-.67)	.0291 (8.20)	.0031 (.55)	.96 (16.71)	.11 (.98)	-.0598 (-8.35)	.0052 (.39)	.43 (3.68)	-.21 (-.90)
1972-77	-.0334 (-4.69)	-.0139 (-1.91)	1.30 (11.63)	.60 (3.93)	.0437 (4.63)	.0012 (.17)	.99 (6.67)	-.66 (-3.68)	-.0772 (-5.13)	-.0150 (-1.35)	.31 (1.33)	1.26 (4.41)
1975-80	-.0223 (-4.25)	.0049 (.99)	.53 (7.06)	.54 (4.93)	.0320 (4.61)	.0038 (.99)	1.61 (16.23)	-.42 (-3.60)	-.0543 (-5.60)	.0011 (.16)	-1.08 (-7.78)	.97 (5.41)
1978-83	-.0340 (-7.85)	.0095 (1.42)	1.04 (14.92)	.09 (.57)	.0400 (5.82)	-.0131 (-2.47)	1.54 (13.92)	-.19 (-1.22)	-.0740 (-8.28)	.0225 (2.60)	-.50 (-3.48)	.28 (1.21)
1981-85	-.0377 (-4.73)	-.0250 (-2.17)	1.11 (6.62)	.19 (.59)	.0349 (7.00)	.0048 (.89)	1.34 (12.81)	-.14 (-.85)	-.0726 (-6.51)	-.0298 (-1.91)	-.23 (-1.00)	.33 (.75)
Aggregate	-.0277 (-25.6)	-.00095 (-.58)	.99 (58.4)	.33 (10.8)	.0311 (21.1)	-.00228 (-1.95)	1.51 (60.3)	-.30 (-7.86)	-.0587 (-27.7)	.00133 (.88)	-.52 (-14.0)	.63 (12.1)

NOTE.— $t$ -statistics are in parentheses. The aggregate test statistic is constructed from test-period  $t$ -statistics, and it follows a standard normal distribution. Model:

$$r_{it} - r_{ft} = \alpha_{1t}(1 - D_t) + \alpha_{2t}D_t + \beta_1(r_{mt} - r_{ft}) + \beta_2(r_{mt} - r_{ft})D_t + \epsilon_{it}$$

where  $r_{mt}$  is the market index,  $r_{ft}$  is the risk-free rate;  $D_t = 0$ , and  $\epsilon_{it} \sim N(0, \sigma_{\epsilon_i}^2)$  in the rank period;  $D_t = 1$  and  $\epsilon_{it} \sim N(0, \sigma_{\epsilon_i}^2)$  in the test period. Thus  $\alpha_{1t}$  = rank-period abnormal return;  $\alpha_{2t}$  = test-period abnormal return;  $\beta_1$  = rank period beta;  $\beta_2$  = change in beta from the rank period to the test period.

TABLE 3      Testing for Abnormal Returns under the Assumption that the Rank-Period and Test-Period Betas Are Not Equal—the Decile Sample

	Loser			Winner			Loser – Winner		
	$\hat{\alpha}_{1t}$	$\hat{\alpha}_{2t}$	$\hat{\beta}_t$	$\hat{\alpha}_{1t}$	$\hat{\alpha}_{2t}$	$\hat{\beta}_t$	$\hat{\alpha}_{1t}$	$\hat{\alpha}_{2t}$	$\hat{\beta}_t$
1930–35	–.0332 (–7.45)	–.0023 (–.29)	.940 (37.64)	.0528 (4.53)	–.0016 (–.19)	1.367 (20.93)	–.0861 (–7.11)	–.0007 (–.06)	–.427 (–6.30)
1933–38	–.0204 (–3.29)	–.0080 (–2.47)	.544 (14.67)	.0187 (1.35)	–.0010 (–.28)	1.724 (20.86)	–.0391 (–2.10)	–.0070 (–1.34)	–1.180 (–10.59)
1936–41	–.0263 (–9.35)	.0053 (.76)	.929 (36.56)	.0297 (6.13)	–.0038 (–1.27)	1.456 (33.30)	–.0560 (–9.94)	.0091 (1.16)	–.526 (–10.34)
1939–44	–.0306 (–4.50)	.0029 (.36)	1.027 (15.19)	.0348 (3.00)	–.0020 (–.57)	1.691 (14.66)	–.0654 (–3.78)	.0049 (.51)	–.664 (–3.85)
1942–47	–.0096 (–2.34)	.0017 (1.26)	.504 (8.07)	.0056 (.55)	–.0051 (–1.05)	2.292 (14.90)	–.0152 (–1.12)	.0068 (1.24)	–1.789 (–8.63)
1945–50	–.0195 (–5.95)	.0002 (.05)	1.014 (17.80)	.0201 (7.12)	.0002 (–.11)	1.188 (24.19)	–.0396 (–8.33)	.0004 (.08)	–.174 (–2.11)
1948–53	–.0173 (–7.22)	–.0052 (–2.57)	.980 (20.40)	.0183 (6.49)	–.0030 (–2.26)	1.214 (21.41)	–.0356 (–7.77)	–.0021 (–.81)	–.234 (–2.54)
1951–56	–.0232 (–9.88)	–.0037 (–.86)	1.181 (15.82)	.0160 (9.49)	.0029 (1.33)	1.084 (20.25)	–.0392 (–10.81)	–.0066 (–1.12)	.097 (.84)
1954–59	–.0165 (–7.86)	.0034 (1.46)	.803 (14.04)	.0188 (7.76)	–.0067 (–2.82)	1.329 (20.10)	–.0353 (–9.36)	.0101 (2.42)	–.526 (–5.12)
1957–62	–.0240 (–10.62)	–.0028 (–.80)	1.291 (21.00)	.0240 (7.99)	–.0018 (–.72)	1.146 (13.99)	–.0480 (–10.26)	–.0010 (–.19)	.145 (1.14)

1960-65	-.0217 (-7.56)	.0014 (.52)	1.213 (20.35)	.312 (2.93)	.0195 (7.32)	-.0014 (-1.08)	1.120 (20.17)	-.232 (-3.31)	-.0412 (-8.22)	.0028 (.80)	.093 (.89)	.543 (3.50)
1963-68	-.0179 (-13.00)	.0028 (.84)	.885 (19.79)	.193 (2.32)	.0187 (7.47)	-.0061 (-1.64)	1.645 (20.21)	-.366 (-3.27)	-.0366 (-11.94)	.0089 (1.62)	-.760 (-7.63)	.558 (3.69)
1966-71	-.0143 (-5.18)	.0014 (.49)	.691 (12.11)	.048 (.65)	.0220 (5.92)	-.0033 (-1.25)	1.378 (17.91)	-.112 (-1.27)	-.0363 (-6.02)	.0047 (.98)	-.687 (-5.51)	.160 (1.09)
1969-74	-.0236 (-6.05)	.0092 (1.43)	1.377 (21.84)	-.067 (-.56)	.0228 (8.24)	.0016 (.34)	.944 (21.01)	.085 (1.00)	-.0464 (-7.85)	.0077 (.74)	.434 (4.53)	-.152 (-.81)
1972-77	-.0292 (-5.56)	-.0027 (-.52)	1.265 (15.33)	.473 (4.27)	.0303 (5.02)	.0001 (.02)	.922 (9.72)	-.435 (-3.71)	-.0595 (-5.52)	-.0028 (-.33)	.343 (2.03)	.908 (4.35)
1975-80	-.0186 (-5.68)	.0023 (.97)	.640 (13.66)	.334 (5.53)	.0174 (4.28)	.0021 (.85)	1.609 (27.61)	-.319 (-4.50)	-.0360 (-5.53)	.0002 (.04)	-.969 (-10.39)	.653 (5.80)
1978-83	-.0224 (-7.21)	.0077 (2.86)	.743 (14.86)	.053 (.70)	.0290 (6.40)	-.0134 (-3.55)	1.382 (18.95)	-.084 (-.78)	-.0514 (-7.13)	.0211 (3.56)	-.639 (-5.51)	.137 (.81)
1981-85	-.0301 (-5.68)	-.0122 (-1.79)	1.128 (10.13)	.040 (.21)	.0251 (6.01)	.0012 (.35)	1.280 (14.56)	-.085 (-1.71)	-.0552 (-6.67)	-.0134 (-1.41)	-.152 (-.87)	.126 (.44)
Aggregate	-.0221 (-28.47)	.00032 (.39)	.953 (75.4)	.231 (11.4)	.0235 (24.1)	-.00236 (-3.18)	1.376 (81.2)	-.222 (-8.72)	-.0456 (-29.65)	.00269 (1.80)	-.423 (-16.0)	.453 (12.0)

NOTE.— $t$ -statistics are in parentheses. The aggregate test statistic is constructed from test-period  $t$ -statistics, and it follows a standard normal distribution. Model:

$$r_{it} - r_{ft} = \alpha_{1t}(1 - D_t) + \alpha_{2t}D_t + \beta_1(r_{mt} - r_{ft}) + \beta_2D(r_{mt} - r_{ft}) + \epsilon_{it}$$

where  $r_{mt}$  is the market index,  $r_{ft}$  is the risk-free rate;  $D_t = 0$  and  $\epsilon_{it} \sim N(0, \sigma_{\epsilon}^2)$  in the rank period;  $D_t = 1$  and  $\epsilon_{it} \sim N(0, \sigma_D^2)$  in the test period. Thus  $\alpha_{1t}$  = rank-period abnormal return;  $\alpha_{2t}$  = test-period abnormal return;  $\beta_1$  = rank-period beta;  $\beta_2$  = change in beta from the rank period to the test period.

average of the true changing beta, the losers are probably even safer in the beginning than the regression estimates suggest. Consistent with the risk explanation of the contrarian strategy, we observe large changes of betas from the rank period to the test period, such that losers are riskier than winners after portfolio formation.

The direction of change of the beta is consistent with the option-leverage effect. In table 3 (the decile sample), for example, losers' betas increase in 16 out of 18 cases, with an average gain of .231. In 11 cases, the change in the beta appears to be reliably different from zero, if we use the 95% level of the *t*-distribution as the critical level. Winners' betas decrease also in the same 16 periods as the losers' betas increase, with an average drop of .222. Out of these 16 are 9 cases where the decrease in beta appears to be reliably different from zero. The beta of the arbitrage portfolio (losers – winners) is on average negative in the rank period but increases in the test period with an average gain of .453. A similar summary can be made for the De Bondt and Thaler sample. In fact, in that sample, the beta of the arbitrage portfolio increases even more, by .604, from the rank period to the test period.<sup>8</sup>

*A comparison of different adjustment methods.* The difference between our conclusion and that drawn by De Bondt and Thaler is due to the different empirical methods used. A comparison of our methods illustrates the sensitivity of abnormal return estimation to different empirical assumptions.

In table 4, we show the market-adjusted returns (raw returns – equally weighted CRSP returns) similar to those De Bondt and Thaler report in their paper. In addition, we also report the CAPM adjusted returns with betas estimated from the rank period and the abnormal returns estimated with test period betas (from tables 2 and 3) for comparison. We report the mean monthly returns and the mean of cumulative returns compounded over individual test periods.<sup>9</sup> The cumulative return on the arbitrage portfolio is calculated as the difference between

8. It has been suggested to me that the estimated changes in betas might be caused partly by measurement errors of another kind such that the true magnitude of changes is overstated. It is argued that, since the loser (winner) stocks are chosen because they have had large negative (positive) returns, we introduce a negative (positive) correlation between the stocks' returns and the market return because the average market return is positive. Thus we underestimate the rank-period betas of losers and overestimate those of winners. This reasoning is incorrect because we select stocks by their mean returns, and the mean returns in excess of the market will be captured by the rank-period intercept in the regression eq. (2). There are, of course, still the measurement errors caused by the true changes in betas. But, as argued before, our OLS estimates probably understate the true changes that occur from the beginning of the rank period to the test period.

9. The last test period consisting of only 2 years is weighted as 2/3.

**TABLE 4** Returns of the Winner and Loser Portfolios after Different Methods of Risk Adjustment, 1933–85

	Monthly*			Cumulative (3-year)†		
	Market-adjusted Returns	Past Beta-adjusted Returns	Test-Period Beta-adjusted Returns	Market-adjusted Returns	Past Beta-adjusted Returns	Test-Period Beta-adjusted Returns
<b>De Bondt and Thaler sample (1933–85):</b>						
Loser	.00491 (2.45)	.00547 (2.72)	–.00095 (–.58)	.294 (1.69)	.349 (1.75)	–.022 (.45)
Winner	–.00095 (–.62)	–.00792 (–4.74)	–.00228 (–1.95)	–.046 (–.91)	–.091 (–5.04)	–.081 (–2.18)
Loser – Winner	.00586 (2.34)	.01397 (4.33)	.00133 (.88)	.340 (1.99)	.439 (2.20)	.058 (.82)
<b>Decile sample (1933–85):</b>						
Loser	.00460 (3.13)	.00548 (3.71)	.00032 (.39)	.251 (1.94)	.334 (2.08)	.019 (.47)
Winner	–.00122 (–1.07)	–.00664 (–5.42)	–.00236 (–3.18)	–.047 (–1.10)	–.119 (–2.88)	–.080 (–2.84)
Loser – Winner	.00582 (2.93)	.01212 (5.07)	.00269 (1.80)	.298 (2.10)	.453 (2.71)	.098 (1.72)

NOTE.—*t*-statistics for market-adjusted returns and past beta-adjusted returns are in parentheses. In the case of the test-period beta-adjusted returns, the statistic is an aggregate of test-period *t*-statistics and follows a standard normal distribution.

\* Market-adjusted return = raw return minus the return on the equally weighted index. Past beta-adjusted return is the prediction error of the Sharpe-Lintner Capital Asset Pricing Model with beta estimated from the rank period. Test period beta-adjusted returns are those reported in tables 2 and 3.

† Cumulative (3-year) return is compounded return over the 3 years after portfolio formation. The 1984–85 period is weighted by 2/3.

the cumulative sums rather than as the cumulative sum of the monthly difference.<sup>10</sup>

The mean monthly market-adjusted return on the arbitrage portfolio (loser – winner) of the De Bondt and Thaler sample is .586% with a *t*-statistic of 2.34, and the mean cumulative compounded return over the 3-year test period is 33.9% with a *t*-statistic of 1.99, similar to the results reported by De Bondt and Thaler. In comparison, our estimate for the mean difference in cumulative excess returns between losers and winners is 5.84% for 3 years in the De Bondt and Thaler sample and 9.86% for 3 years in the decile sample.

As expected from the rank-period betas, the arbitrage portfolio earns

10. Although the cumulative return reported is not strictly a buy-and-hold return, taking the difference of two cumulative returns implicitly requires less rebalancing than does computing the cumulative sum of the difference.

an even larger abnormal gain when we adjust returns with rank-period betas. The return between losers and winners in the De Bondt and Thaler sample is 1.126%, and the return in the broader sample is 1.211% per month, or 44% and 45% in 3 years. It should be noted that De Bondt and Thaler do not report returns estimated by means of this procedure in their paper, but this example serves to illustrate one property of the contrarian strategy—its risk can be badly misestimated when securities are experiencing large value changes.

In sum, if our risk adjustment is appropriate and adequate, we find only weak evidence of price reversals, even though the stocks in our sample have experienced very large abnormal gains or losses prior to the test periods.<sup>11</sup> It is worth emphasizing that our conclusion is reached on the basis of the size of abnormal return as well as the reliability of the effect. The magnitude of the price reversals we find is small and probably conveys little economic information.

#### IV. Correlation between Beta and the Market-Risk Premium

Although the return to the strategy of buying losers and selling winners can be explained by beta, the average beta of this strategy is in fact very small when compared to the average return to be explained. Thus the ability of the CAPM to explain the reversal effect is owing not to the long-term difference between the betas of the loser and winner portfolios but to the short-term differences measured over 3-year test periods. From table 2, the average test-period betas ( $\hat{\beta}_i + \hat{\beta}_{iD}$ ) of the loser and winner portfolios in the De Bondt and Thaler sample are 1.315 and 1.208, respectively, with a difference of .107. The average market-risk premium in 1933–85 is 1.218% per month, thus the average beta only explains .13% per month ( $.107 \times 1.218\%$ ) of the .586% difference in average monthly returns. In the decile sample, we find a similar disparity. The average beta of the arbitrage portfolio is .030 and the average return to be explained is .582%.

The insignificance of the difference in long-term betas between losers and winners suggests that our risk-adjustment procedure is successful in explaining most of the return difference because it is able to capture the correlation between the (time-varying) betas and the market-risk premium. In our empirical model, the portfolio beta changes at resampling every 3 years. In other words, for the CAPM to explain the raw returns we observe, losers' betas need not be bigger than winners' betas all the time or even on average; they just need to be bigger in the

11. When the test-period beta is allowed to vary from year to year, the mean estimated abnormal returns of the arbitrage portfolio is even smaller than previously estimated. It drops by .1% to .03% ( $t = .12$ ) and by .068% to .201% ( $t = 1.10$ ) per month in the De Bondt and Thaler and decile samples, respectively. We have no statistical evidence that the test-period beta is nonstationary.

test period when the expected market premium is high. To illustrate this argument, we stack the different test periods together and write down a return-generating model for portfolio  $i$  in the 1933–85 period as

$$r_{it} = \alpha_{it} + \beta_{it}r_{mt} + \epsilon_{it}, \quad (3)$$

where returns are excess returns. The  $\alpha_{it}$  and  $\beta_{it}$  are assumed to be constant within a test period, but they change as we move to a different test period. Making use of the definition of sample covariance, the sample average return is given by

$$\bar{r}_i = \bar{\alpha}_i + \widehat{\text{cov}}(\beta_{it}, r_{mt}) + \bar{\beta}_i \cdot \bar{r}_m. \quad (4)$$

If we simply perform risk adjustment with the long-term beta  $\bar{\beta}_i$ , the mean risk-adjusted return  $(\bar{r}_i - \bar{\beta}_i \cdot \bar{r}_m)$  will contain the true excess return  $\bar{\alpha}_i$  and the covariance term. One way to make this mistake is to run equation (3) as a regression over all testing periods. Since the OLS beta is somewhat like the average of the time-varying betas, the intercept will contain the covariance term.

Table 5 provides a breakdown of the explained average returns into two components, the covariance component and the average beta component. The  $\bar{\alpha}_i$  is the average abnormal return estimated by test-period betas in tables 2 and 3, the average beta component is computed as the average test-period beta (from tables 2 and 3) multiplied by the average market-risk premium, and the covariance component is then inferred from equation (4). The covariance component is nontrivial. For in-

TABLE 5 Components in the Explained Average Return

			Return Explained by		
	Average Beta $\bar{\beta}_i$	Average Excess Return $\bar{r}'_i$	Average Beta $\bar{\beta}_i \cdot \bar{r}'_m$	Covariance Effect $\text{cov}(\beta_{it}, r'_{mt})$	Unexplained Return $\bar{\alpha}_i$
De Bondt and Thaler sample (1933–85):					
Loser	1.315	.01709	.01602	.00202	– .00095
Winner	1.208	.01123	.01471	– .00121	– .00228
Loser – Winner	.107	.00586	.00130	.00323	.00133
Decile sample (1933–85):					
Loser	1.184	.01678	.01442	.00204	.00032
Winner	1.154	.01096	.01406	– .00073	– .00236
Loser – Winner	.030	.00582	.00037	.00277	.00268

NOTE.—Average betas and average unexplained returns are estimated under the assumption the beta in the test period is constant. See tables 2 and 3. Model:

$$\bar{r}'_i = \bar{\alpha}_i + \widehat{\text{cov}}(\beta_{it}, r'_{mt}) + \bar{\beta}_i \cdot \bar{r}'_m,$$

where  $r'_{it} = (r_{it} - r_{ft})$  and  $r'_{mt} = r_{mt} - r_{ft}$ ,  $r_{mt}$  and  $r_{ft}$  being the market return and the bill rate.

stance, the Sharpe-Lintner CAPM explains .453% of the arbitrage portfolio return in the De Bondt and Thaler sample. Of that, .130% is explained by the average beta, and .323% by the covariance between the beta and the market premium. The covariance component explains .277% of the arbitrage return in the decile sample. The table also suggests that the loser portfolio's beta is positively, and the winner portfolio's beta negatively, correlated with the market-risk premium.

This correlation is unlikely to be due to estimation errors of the betas because the estimation errors are uncorrelated with the expected risk premium. An interpretation of the correlation is that our portfolio selection procedure picks very risky losers when the expected market-risk premium is high and less risky losers when the expected market-risk premium is low, so that the difference in risk between losers and winners is positively correlated to the market-risk premium. We will suggest how this correlation is possible.

While many economic variables might explain the variation of the market-risk premium, we expect that the real output of the economy is one of the more important determinants. An explanation of the correlation between betas and the market-risk premium, therefore, is that the betas are correlated with real activity. A way to get this correlation, and one that we have demonstrated, is that betas increase as the stock values fall. If the stocks that go into the loser portfolio suffer larger losses in recession than in economic expansion, the portfolio beta will be negatively related to the level of economic activity. Similar effects in the opposite direction may affect the winner portfolios. In any case, since cross-sectional betas of all securities must sum to one, the winner portfolio beta decreases when the loser portfolio beta increases, other things being equal. Because the expected market-risk premium is probably also negatively correlated with the level of the economic activity, it will be positively correlated with the loser portfolio's beta and negatively correlated with the winner portfolio's beta. The discussion above is drawn on Chan and Chen (1986, 1987), who find some evidence that the market-risk premium and betas of portfolios sorted by size are correlated with the predetermined industrial production index. We find similar correlation between the industrial production and the betas of the loser and winner portfolios, but the industrial production index alone appears to account for a part of the variations in betas and the risk premium.<sup>12</sup>

## V. Conclusion

The estimation of the abnormal return to the contrarian investment strategy is sensitive to the model and estimation methods. Using a

12. Detailed results are available upon request.



simple asset-pricing model, the CAPM, and an empirical method that is free of the problems caused by risk changes, we find that the contrarian strategy earns a very small abnormal return, which is probably economically insignificant. If the experiment is interpreted as a test of market overreaction, we find no strong evidence in support of the hypothesis.

Two features about winners and losers in the stock market make the estimation of abnormal returns sensitive to the procedures used. First, the losers' betas increase after a period of abnormal loss, and the winners' betas decrease after a period of abnormal gain. Betas estimated from the past should not be used. Second, when we evaluate the risk-return relation over an extended period of time that involves updating of portfolios, it is incorrect to base the analysis on the relation between the average return and average beta because both the betas and expected market-risk premium might respond to some common state variables and are thus correlated. The contrarian strategy appears to have an ability to pick riskier losers when the expected market-risk premium is high, probably because losers suffer larger losses at economic downturns than at upturns. An investor who follows the contrarian strategy is likely to find that his or her risk exposure varies inversely with the level of economic activity (and consumption). On average, the investor realizes above-market returns, but that excess return is likely to be a normal compensation for the risk in the investment strategy.

## References

- Banz, Rolf. 1981. The relationship between return and market value of common stock. *Journal of Financial Economics* 9:3–18.
- Black, F.; Jensen, M.; and Scholes, M. 1972. The capital asset pricing model: Some empirical tests. In M. Jensen (ed.), *Studies in the Theory of Capital Markets*. New York: Praeger.
- Chan, K. C., and Chen, Nai-fu. 1986. Unconditional test of asset pricing and the role of firm size as an instrumental variable for risk. Working paper. Columbus: Ohio State University.
- Chan, K. C., and Chen, Nai-fu. 1987. Business cycles and the returns of small and large firms. Working paper. Chicago: University of Chicago.
- De Bondt, Werner, and Thaler, Richard. 1985. Does the stock market overreact? *Journal of Finance* 40, no. 3 (July): 793–805.
- De Bondt, Werner, and Thaler, Richard. 1987. Further evidence on investor overreaction and stock market seasonality. *Journal of Finance* 42, no. 3 (July): 557–82.
- Fama, Eugene, and French, Kenneth R. 1986. Common factors in the serial correlation of stock returns. Working paper. Chicago: University of Chicago.
- Kahneman, D., and Tversky, A. 1982. Intuitive prediction: Biases and corrective procedures. In D. Kahneman, P. Slovic, and A. Tversky (eds.), *Judgement under Uncertainty: Heuristics and Biases*. New York: Cambridge University Press.
- Merton, Robert C. 1985. On the current state of the stock market rationality hypothesis. Working Paper no. 1717-85. Cambridge, Mass.: Massachusetts Institute of Technology, Sloan School of Management, October.
- Roll, Richard. 1977. A critique of the asset pricing theory's tests: Part I: On past and potential testability of the theory. *Journal of Financial Economics* 4 (March): 129–76.