

Overreaction and Insider Trading: Evidence from Growth and Value Portfolios

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ABSTRACT

Insider transactions are not random across growth and value stocks. We find that insider buying climbs as stocks change from growth to value categories. Insider buying also is greater after low stock returns, and lower after high stock returns. These findings are consistent with a version of overreaction which says that prices of value stocks tend to lie below fundamental values, and prices of growth stocks tend to lie above fundamental values.

DO MARKET PRICES REFLECT investor overreaction?¹ The purpose of this paper is to provide evidence on this question. However, new evidence is unlikely to change many minds if the findings depend on the newly controversial capital asset pricing model (CAPM) or multifactor models, or if they involve data-snooping.² We bypass these problems by not using CAPM or a benchmark model, and by examining a new set of data.

We measure insider buying and selling in stocks that are ranked by measures such as the ratio of cash flow per share to price per share (CF/P).³ Current practice refers to stocks with low CF/P as *growth* stocks, and to stocks with high CF/P as *value* stocks. We examine the direction of insider trades along the growth/value spectrum to see if they are consistent with attempts to profit from market overreaction. By overreaction, we mean price movements that predictably reverse. This experiment does not require an asset-pricing model because we do not examine the returns accruing to insider trades.⁴

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¹ See De Bondt and Thaler (1985), Chopra, Lakonishok, and Ritter (1992), Ball, Kothari, and Shanken (1995), and Chan, Jegadeesh, and Lakonishok (1995) for representative research addressing market overreaction.

² See Daniel and Titman (1997), Fama and French (1996), Jagannathan and Wang (1996), and Kim (1995) for recent conflicting evidence on CAPM and multifactor models. See Lo and MacKinlay (1990) and Black (1993) for discussions of data-snooping.

³ Lakonishok, Shleifer, and Vishny (1994) show that CF/P, and such other measures as book value per share to price per share, effectively sort stocks into different expected return categories.

⁴ For evidence on the profitability of insider trades, see, for example, Seyhun (1986) and Rozeff and Zaman (1988).

In one version of overreaction, DeBondt and Thaler (1985) focus on mispricing of stocks as detected by extreme behavior of past returns. In a second version, Basu (1977) and Lakonishok et al. (1994) propose that departures from fundamental values can be measured with valuation ratios such as earnings to price ratios or CF/P.⁵ In this paper, we adopt the latter approach. Like Lakonishok et al., we construct CF/P portfolios, all of which have similar average market value of equity. The portfolios contain many more stocks than the 50 extreme winners and losers examined by DeBondt and Thaler (1985).⁶

Recent papers on pricing anomalies debate whether relations between stock returns and variables like CF/P arise from overreaction that provides profit opportunities or from rational risk factors that do not (Lakonishok et al. (1994), Fama and French (1996), Daniel and Titman (1997)). By examining insider trading among growth and value stock categories, we hope to provide new insight into this issue without getting into the benchmark problem. Assume that value stocks are undervalued and growth stocks are overvalued and/or provide profit opportunities to some investors. Then corporate insiders, who presumably have superior information, have incentives to take advantage of the misvaluations, to the legally permissible extent, by buying value stocks more heavily and/or selling growth stocks more heavily. On the other hand, if growth and value categories do not meaningfully measure deviations of stock prices from fundamental values, then we do not expect insider trades to be related to these categories.

There is some evidence that insiders tend to buy more heavily the shares of small companies (Seyhun (1986), Rозеff and Zaman (1988)). However, market anomalies such as the size and CF/P effects have not been discovered by investigating the nature of insider trades. Furthermore, Lakonishok et al. (1994) document that the average size of stocks in different CF/P portfolios is virtually the same. Therefore, we believe that our experiment avoids the taint of data-snooping.

Our three main findings are as follows: (1) Cross-sectionally, the buying trades of insiders increase in frequency relative to selling trades as stocks increasingly become value stocks. (2) Insider buying of value stocks increases as individual stocks change from the growth to the value categories. (3) Insiders increase their sales after the stocks experience high returns.

Section I provides further background and explains the hypotheses of the study, Section II discusses data and methodology, and Section III provides the findings. Section IV concludes the paper.

⁵ Fundamental value refers to a price toward which market price tends in a predictable way.

⁶ In a critique directed at De Bondt and Thaler (1985), but not Lakonishok et al. (1994), Ball et al. (1995) point out problems in measuring extreme portfolio returns. By construction, the CF/P portfolios are unlikely to have peculiarities associated with price levels per se or market values of equity.

I. Background and Hypotheses

A. Hypotheses

Suppose that insider trades are motivated, at least in part, by private information and knowledge concerning equity values. Suppose also that the public information set of outsiders leads to deviations of market prices from the values perceived by insiders. Such deviations can arise if costs of arbitrage and/or risks make it unprofitable for insiders instantaneously and immediately to arbitrage away all differences between market prices and fundamental values.⁷

We first define the *random* hypothesis. Under this hypothesis, we suppose that deviations of market prices from fundamental values arise randomly across all types of stocks. Pricing errors occur, but they do not crop up systematically in particular kinds of stocks, such as growth or value stocks. As a consequence, arbitrage-motivated insider buying and selling is not focused systematically on any particular category of stock. Under the random hypothesis, if stocks are sorted by valuation measures such as CF/P, insider trades will be unrelated to the valuation category.

An alternative hypothesis is *overreaction*. The scenario of deviations from fundamental values is similar to that expressed in the random hypothesis, except that outsiders are now hypothesized to overvalue growth stocks and undervalue value stocks. That is, their pricing errors concentrate in particular stock categories. The reason for this behavior is not altogether clear. It could be a systematic tendency for outsiders to project growth too far into the future and to underestimate the recovery potential of distressed companies (Haugen (1995)). Assuming that insiders rely on their information and do not overreact, then the overreaction hypothesis predicts that insiders will focus greater buying in the value stocks and greater selling in the growth stocks, hoping to profit by the eventual reversion of market prices to their fundamental values.

Lakonishok et al. (1994) find that CF/P and book value to price (BV/P) portfolios display strong return differences cross-sectionally. We therefore focus on insider trading in portfolios created on the basis of CF/P ratios. As robustness tests, we replicate the findings using BV/P ratios. If market prices of high CF/P stocks systematically fall short of their fundamental values, and market prices of low CF/P stocks lie above fundamental values, then the overreaction hypothesis predicts that corporate insiders tilt their trading to more purchases of high CF/P stocks and fewer purchases of low CF/P stocks. The random hypothesis predicts no difference in the fraction of trades that are buys and sells in categories of stocks sorted by the CF/P measure. The random hypothesis therefore functions as a natural null hypothesis. Rejection in the direction of more insider buys in value stocks and/or more sells in growth stocks is consistent with overreaction.

⁷ See Lin and Rozeff (1994) and Shleifer and Vishny (1997).

B. Other Hypotheses

Seyhun (1986) shows that insider buy trades tend to occur after price declines and insider sell trades tend to occur after price rises. This behavior is consistent with both the random and overreaction hypotheses because the price deviations could be randomly distributed across stocks or could be concentrated in particular categories. However, there is an alternative hypothesis that may partly explain the pattern of insider trading found by Seyhun. We call it the *diversification* hypothesis.

Stocks classified as having low CF/P ratios could be in that category because they have experienced pronounced recent increases in stock price. Such price rises, in turn, raise the wealth of insiders who own the shares. The insiders may elect to sell shares more heavily in the low CF/P stocks because it is in these stocks that they find their portfolio holdings most heavily concentrated. Bill Gates, for example, is a frequent seller of large quantities of Microsoft stock. The diversification hypothesis predicts that, if stocks enter these categories due to pronounced recent changes in price, even though there is no price deviation from an efficient market valuation, there is relatively greater selling in low CF/P shares than in high CF/P shares. Greater selling in low CF/P stocks is also consistent with the overreaction hypothesis if high returns over the prior year, due to overreaction, push stocks into low CF/P categories.

In this study, we employ variables measuring past returns to control for the tendency of insider trading to depend on past returns, whether arising from diversification motives or attempts to take advantage of overreaction. In addition to allocating stocks by CF/P deciles, we also divide them into categories based on the rank of their return in one or more years prior to the insider trades. This procedure allows a more powerful test of the overreaction and random hypotheses with respect to CF/P deciles only.

A fourth hypothesis, which we call the *holdings* hypothesis, reasons that low CF/P ratios and greater insider selling have a common cause. Suppose that executives are paid greater amounts in stock in more successful firms. Such firms will tend to have values that are high and CF/P ratios that are low. If executives in successful firms are paid relatively less in straight salary, they sell stock to convert the stock component of their salary into cash. The holdings hypothesis implies that executives in the low CF/P firms have relatively larger stock holdings, which in turn lead to relatively more stock sales than occur in the high CF/P firms. We test this hypothesis by examining the relation between insider holdings and CF/P categories.

II. Data and Methodology

We obtain cash flow and book value data from the Annual Compustat Industrial tape over the years 1978 to 1991. The starting year of 1978 allows us to use machine-readable insider trading transactions data. We define cash flow as the sum of Income Before Extraordinary Items and Discontinued

Operations (Compustat Item 18) and Depreciation and Amortization (Compustat Item 14). Book value uses Compustat Item 60. The cash flow for year t is divided by the market value of equity at the end of May in year $t + 1$. Market value of equity is the product of the number of shares outstanding and the end-of-May stock price, both of which we obtain from the Center for Research on Security Prices (CRSP) Monthly NYSE-AMEX files. If either cash flow or market value of equity is unavailable for that year for a company, the company is excluded for that year. We also eliminate instances when cash flow is negative.⁸ We eliminate certain issues from the tests, namely, all issues that have a CRSP sharecode greater than two. Hence we include only ordinary common shares and eliminate ADRs and capital shares. In cases where there are several classes of stock, the market value of equity is the sum of the values of the two issues. These procedures are patterned after those of earlier papers such as that by Lakonishok et al. (1994) and produce CF/P portfolios that have similar average values to those of Lakonishok et al.

After obtaining a ratio of cash flow to market value of equity each year for each company, the companies are sorted into deciles each year by the CF/P ratio and assigned a value of one to ten. Stocks ranked one have the lowest CF/P ratios and are called the growth stocks. Stocks ranked ten have the highest CF/P ratios and are called the value stocks. Parallel procedures are used to create a separate sample of stocks in BV/P deciles.

There are several reasons for working with CF/P deciles rather than actual cash flow to price ratios. The main reason is that median values of CF/P ratios show considerable intertemporal variation. This makes it inappropriate to rank stocks over all years. A second reason is that many ratio measures contain outliers and have nonnormal distributions. Deciles avoid the associated statistical problems of inference. The third reason is that using annual decile ranks makes the research comparable with prior studies.

Next we find the returns of each stock in periods prior to May of year $t + 1$. We examine 12-month and 36-month periods. For example, in 1978 the 12-month return for 1978 consists of the buy-and-hold annual return from June of 1977 through May of 1978. If one or more of the monthly returns of a stock is missing, the stock is eliminated for that year. We pool the 12-month (and 36-month) returns of all companies over all the years and rank them from highest to lowest. We then divide the sample into thirds, which we refer to as the High, Medium, and Low return categories. Pooling the sample returns over all years makes the implicit assumption that the mean of the distribution of stock returns is stable intertemporally. Although this assumption is not literally correct, it is ordinarily difficult to detect large variations in expected returns.

Table I provides details of sample sizes. The number of firm-years in the combined CRSP-Compustat samples within the cash flow and return cat-

⁸ In separate samples that create BV/P deciles, we eliminate a firm-year if book value is either negative or unavailable for that year.

Table I
Descriptive Statistics of Cash Flow to Price
(CF/P) Deciles, 1978–1991

The Annual Compustat Industrial tape for the years 1978 to 1991 is the source of cash flow data. Cash flow is the sum of Income Before Extraordinary Items and Discontinued Operations (Compustat Item 18) and Depreciation and Amortization (Compustat Item 14). The cash flow for year t is divided by the market value of equity at the end of May in year $t + 1$. Market value of equity is the product of the number of shares outstanding and the end-of-May stock price, both of which we obtain from the Center for Research on Security Prices (CRSP) Monthly NYSE–AMEX files. If either cash flow or market value of equity is unavailable for that year for a company or if cash flow is negative, the company is excluded for that year. The companies are sorted into deciles each year by the CF/P ratio and assigned a value of one to ten. Stocks ranked one have the lowest CF/P ratios and stocks ranked ten have the highest CF/P ratios. Next we find the buy-and-hold annual return of each stock in the 12 months prior to May of year $t + 1$. If one or more of the monthly returns of a stock is missing, the stock is eliminated for that year. We pool the annual returns of all companies over all the years and rank them from highest to lowest. We divide the sample into thirds and assign the value one to the stocks with the highest returns and the value three to the stocks with the lowest returns.

Return Category	Low CF/P Ratios					High CF/P Ratios				
	1	2	3	4	5	6	7	8	9	10
Panel A: Number of Firm-Years in Each CF/P Decile										
1	510	524	500	441	448	352	358	351	291	251
2	369	346	374	388	383	427	464	508	502	356
3	345	309	331	382	387	393	413	384	451	624
Panel B: Average Market Value of Equity of CF/P Deciles in Millions, 1978–1991										
1541	1604	1628	1584	1525	1411	1291	1681	1843	1293	
Panel C: Average Value of CF/P in CF/P Deciles, 1978–1991										
0.054	0.081	0.108	0.127	0.146	0.166	0.190	0.219	0.256	0.386	

egories over the 14-year sample period is 12,162, or an average of 869 firms each year. The cash flow deciles average 1,216 firm-years each, with a range from 1,172 to 1,244. The return categories have 4,019 to 4,117 firm-years each.

In the high return category, the number of firm-years falls from 510 in the lowest CF/P deciles to 251 in the highest CF/P category. In the low return category, the number of firm-years rises from 345 in the lowest CF/P deciles to 624 in the highest return category. Most of the change occurs in the highest CF/P decile. Fewer stocks in the highest CF/P deciles experience high returns over the prior year, and more experience low returns. Nevertheless, substantial numbers of firm-years appear in all the categories and allow testing of the separate return and CF/P effects. We shall see in the regression tests that the association between CF/P deciles and prior return categories has little or no effect on the findings.

Table II
Percentages of Buy Transactions in Three Categories
of Insiders, 1978–1991

The Annual Compustat Industrial tape for the years 1978 to 1991 is the source of cash flow data. Cash flow is the sum of Income Before Extraordinary Items and Discontinued Operations (Compustat Item 18) and Depreciation and Amortization (Compustat Item 14). The cash flow for year t is divided by the market value of equity at the end of May in year $t + 1$. Market value of equity is the product of the number of shares outstanding and the end-of-May stock price, both of which we obtain from the Center for Research on Security Prices (CRSP) Monthly NYSE–AMEX files. We find the insider trading transactions of the companies in the decile CF/P portfolios using data compiled by the Securities and Exchange Commission (SEC) and available on several tapes from the National Archives and Records Administration. We restrict the transactions to open-market purchases and sales. Option related and other transactions are ignored. We count open-market purchases and sales in the February–May test period of each year. The table shows the percentage of buys of all open-market buys and sells for three insider categories and all insiders combined. The category “Chairmen” includes chairmen of the board. “Officers” includes officers, officers and directors, officers and beneficial owners, and officers and trustees. “Directors” includes directors and directors and beneficial owners. The chi-square statistic tests for differences across the deciles. Probability refers to the probability of obtaining the chi-square value.

CF/P Decile	Percent Buys (# Buys/All Trans.)			
	Chairmen	Officers	Directors	All Insiders
1	35.5 (11/31)	20.1 (77/383)	50.1 (173/345)	34.4 (261/759)
2	26.9 (7/26)	19.5 (69/354)	57.5 (196/341)	37.7 (272/721)
3	28.0 (7/25)	22.1 (81/366)	61.4 (199/324)	40.1 (287/715)
4	52.2 (12/23)	20.5 (67/327)	66.9 (224/335)	44.2 (303/685)
5	42.3 (11/26)	25.4 (83/327)	69.5 (230/331)	47.4 (324/684)
6	73.7 (14/19)	26.6 (76/286)	67.5 (210/311)	48.7 (300/616)
7	53.9 (14/26)	28.1 (75/267)	70.0 (233/333)	51.4 (322/626)
8	52.9 (9/17)	25.9 (69/266)	79.4 (228/287)	53.7 (306/570)
9	76.0 (19/25)	29.6 (69/233)	79.0 (230/291)	57.9 (318/549)
10	63.2 (12/19)	32.6 (74/227)	80.4 (218/271)	58.8 (304/517)
Column	Mean = 48.9	Mean = 24.4	Mean = 67.6	Mean = 46.5
Chi. sq.	26.12	64.48	127.96	
Prob.	0.004	0.000	0.000	

We find the insider trading transactions of the companies in the portfolios using data compiled by the Securities and Exchange Commission (SEC) and available on several tapes from the National Archives and Records Administration. We restrict the transactions to open-market purchases and sales. Option related and other transactions are ignored. Because many stocks have no open-market purchases and sales in the February–May test period, sample sizes are cut approximately in half. In Table II the total of buy and sell transactions in three categories of insiders is 6,442.⁹

⁹ Sample sizes using BV/P deciles exceed 9,000 because negative cash flows occur more frequently than negative book values.

The CF/P ratios of the sample vary from an average of 0.0537 in decile 1 to 0.3858 in decile 10. These values are close to Lakonishok et al.'s (1994) values. Across years, the average CF/P ratios range from a low of 0.1171 in 1987 to a high of 0.2524 in 1982. That is, prices typically range from four to eight times cash flow in the overall market. Lakonishok et al. point out that market value of equity is not correlated with the values of CF/P across the CF/P deciles, and the CF/P anomaly is not a disguised version of the size effect. Across all years, the average market values of equity in the ten deciles of our sample range from a high of 1.84 billion dollars in decile 9 to 1.29 billion dollars in deciles 7 and 10. Deciles 1 to 6 and 8 have mean sizes in the narrow range of 1.41 to 1.68 billion dollars. Hence, as in Lakonishok et al., the deciles of CF/P do not have significant differences in average size.

III. Findings

In each month of the four-month period ending in May of each year, for each stock in a portfolio, we count the number of insider buys and sells. We then sum the total numbers of buys and sells over all firm-years within each CF/P decile. Table II reports the percentages of open market purchases by CF/P decile and by category of insider (chairmen of the board, officers, and directors). The trends that are apparent in this table foreshadow what the regression tests will verify.

The average percentages of buy transactions across all CF/P deciles are quite different for the three types of insiders, being 48.9, 24.4, and 67.6 percent for chairmen, officers, and directors, respectively. Nevertheless, within each category of insider, the fraction of buys tends to increase as the CF/P decile changes from growth to value stocks. Among chairmen, the fraction of insider trades that are purchases rises from 35.5 percent to 63.2 percent between deciles 1 and 10. The change between deciles 2 and 9 from 26.9 to 76.0 percent is even more dramatic. Officers increase their buy transactions from 20.1 percent of all transactions in growth stocks to 32.6 percent in the value stocks. Finally, among directors, purchases of stocks increase from 50.1 percent of decile 1's growth stocks to 80.4 percent of decile 10's value stocks. The differences across deciles are highly significant as evidenced by high chi-square statistics. Across the three classifications of insiders, the percentage of buys goes up from 34.4 to 58.8 percent as one moves from growth to value stocks. These striking differences in behavior have not, to our knowledge, been previously reported in the finance literature.

To obtain significance tests of the patterns reported in Table II, we conduct regressions using dummy variables for the CF/P deciles and the return categories. Panel A of Table III reports the results of a cross-sectional regression of a firm's fraction of all open-market transactions that are purchases against dummy variables for cash flow deciles 1 through 9. A dummy variable is one if the firm falls into that CF/P decile in the firm-year con-

sidered and is zero otherwise. The regression intercept measures the average fraction of buys in the value stock decile 10.

The regression model has an adjusted R^2 of 0.032. The estimate of the average fraction of purchases in CF/P decile 10 is 47.4 percent. The dummy variable for decile 1 is -0.22 and highly significant ($t = -9.81$), implying an estimated fraction of buys in CF/P decile 1 of 25.4 percent. The dummy variables for deciles 2 through 7 are similarly significant and have negative regression coefficients that decline monotonically from -0.211 to -0.060. Hence, the evidence shows significantly higher insider buying as one passes from low CF/P deciles (growth stocks) to high CF/P deciles (value stocks). The only exception to the near-monotonic increase is that the fraction of purchases is slightly higher in decile 9 than in decile 10.

Panel B shows the impact of past return on insider transactions. The two dummy variables are defined for return category 1, the highest return category, and for category 2. Hence, the intercept estimates the fraction of insider purchases in the lowest return category 3.

The regression of the fraction of insider purchases against the return variables is highly significant, with an adjusted R^2 of 0.028 and an intercept estimate of 45.5 percent. Both dummy variables are significantly negative, indicating that there is lower insider buying as the prior returns of the stock increase. The regression estimate of the buying fraction in the highest return category is 28.3 percent, and for the middle return category it is 39.4 percent.

Because past returns influence the nature of subsequent insider trading, we obtain a more powerful test of the effect of CF/P by controlling for this source of variation. Panel C of Table III shows regressions that employ both the CF/P and return categories. We examine a combined regression that includes dummies for both CF/P deciles and return categories. This model has an adjusted R^2 of 0.050, but the sum of the adjusted R^2 of the separate CF/P and return regressions is 0.06. This suggests a substantial degree of independence in the two effects.

In this model, the estimated intercept is 51.8 percent, which represents the buying in the lowest return, highest CF/P decile. The highest growth decile has an estimate that is a significant 17.7 percent lower, or 34.1 percent buys. The next six CF/P dummy variables are likewise significant, and the coefficient estimates are negative. Hence, controlling for prior returns, we observe basically the same picture that we obtained in Panel A. Insider buying increases as one passes from growth stocks to value stocks, and the tendency to increase is almost monotonic.

At the same time, the return dummy variables maintain their significance. Hence, holding constant for cash flow decile, insider buying declines as past returns increase. According to the regression, if we combine the two effects, the highest CF/P and lowest return category receives insider buying in 51.8 percent of the insider transactions, and the lowest CF/P and highest return category receives insider buying in only 19.8 percent of transactions. The differences appear to be significant economically as well as statistically.

Table III
Regressions Explaining the Proportion of Insider Buys by Cash Flow to Price (CF/P) Deciles and 12-Month Returns, 1978–1991

The dependent variable in the three regressions in Panels A, B, and C is the number of open market purchases by all insiders in a firm divided by the total number of open-market purchase and sale transactions for each firm-year in the sample. The Annual Compustat Industrial tape for the years 1978 to 1991 is the source of cash flow data. Cash flow is the sum of Income Before Extraordinary Items and Discontinued Operations (Compustat Item 18) and Depreciation and Amortization (Compustat Item 14). The cash flow for year t is divided by the market value of equity at the end of May in year $t + 1$. Market value of equity is the product of the number of shares outstanding and the end-of-May stock price, both of which we obtain from the Center for Research on Security Prices (CRSP) Monthly NYSE–AMEX files. We find the insider trading transactions of the companies in the decile CF/P and three return portfolios using data compiled by the Securities and Exchange Commission (SEC) and available on several tapes from the National Archives and Records Administration. We restrict the transactions to open-market purchases and sales. Option related and other transactions are ignored. We count open-market purchases and sales in the February–May test period of each year. The independent variables in Panels A and C include the CF/P decile dummy variables, where the variable equals one if it is in that decile and zero otherwise. Decile CF/P one has the lowest CF/P values and decile CF/P ten has the highest. For each 12 months ending in May of each year, we find the buy-and-hold return of any firm that has insider open-market insider transactions. The returns are pooled over all years and divided into three categories: High, Medium, and Low returns. The return variables in Panels B and C include the return dummy variables, labeled High for the highest prior 12 months' buy-and-hold return and Medium for the middle values of the prior 12 months' return. The table shows coefficient estimates and test statistics for the regressions estimated over all firm-years for the period 1978 to 1991. The intercept of the regression in Panel A estimates the proportion of insider buys for the highest CF/P category; in Panel B it estimates the proportion of insider buys for the lowest return category; and in Panel C it estimates the proportion of insider buys for the highest CF/P and lowest return category.

Variables	Coefficients	<i>t</i> -Statistics	<i>p</i> -Values
Panel A: Cash Flow Dummy Variable Regression; adjusted $R^2 = 0.032$			
Intercept	0.474	27.79	0.0001
CF/P 1	−0.220	−9.81	0.0001
CF/P 2	−0.211	−9.34	0.0001
CF/P 3	−0.163	−7.19	0.0001
CF/P 4	−0.136	−5.93	0.0001
CF/P 5	−0.089	−3.93	0.0001
CF/P 6	−0.077	−3.30	0.0010
CF/P 7	−0.060	−2.57	0.0100
CF/P 8	−0.024	−0.99	0.3200
CF/P 9	0.007	0.30	0.7700
Panel B: Return Dummy Variable Regression; adjusted $R^2 = 0.028$			
Intercept	0.455	53.19	0.0001
High return	−0.172	−14.52	0.0001
Medium return	−0.062	−5.07	0.0001
Panel C: Cash Flow and Return Dummy Variable Regression; adjusted $R^2 = 0.050$			
Intercept	0.518	29.00	0.0001
High return	−0.143	−11.57	0.0001
Medium return	−0.057	−4.59	0.0001

Table III—Continued

Variables	Coefficients	t-Statistics	p-Values
Panel C: <i>continued</i>			
CF/P 1	-0.177	-7.77	0.0001
CF/P 2	-0.179	-7.78	0.0001
CF/P 3	-0.129	-5.64	0.0001
CF/P 4	-0.115	-4.99	0.0001
CF/P 5	-0.065	-2.82	0.0050
CF/P 6	-0.059	-2.50	0.0130
CF/P 7	-0.044	-1.88	0.0600
CF/P 8	-0.010	-0.41	0.6800
CF/P 9	0.018	0.75	0.4500

A. Robustness Tests

We test the robustness of these findings in two ways: by extending the returns period from 12 to 36 months and by expanding the study to BV/P portfolios.

Table IV shows the results of regressing the proportion of insider buys against dummy variables for BV/P decile and return category when returns are sorted by prior 36-month returns. The nature of the findings is little changed from Table III, except that the adjusted R^2 's are larger in Table IV. For example, the combined regression (see Panel C) using both deciles of BV/P and return dummies has an adjusted R^2 of 0.071, compared to 0.050 for the comparable CF/P regression. In Table IV every dummy variable is significant. That is, even deciles close to decile 10 have significantly more insider selling than decile 10. A clear tendency for selling to rise as BV/P declines also is present. Similar findings (not reported) occur if 36-month returns are combined with CF/P deciles or if 12-month returns are combined with BV/P deciles.¹⁰ Clearly, the extensions to BV/P deciles and 36-month return periods strongly support the CF/P evidence.

B. Test of Holdings Hypothesis

Under the holdings hypothesis, insider selling is said to fall with the ratio of cash flow to price because stocks with low cash flow to price ratios have higher fractions of stock held by insiders. To examine if stocks with lower cash flow to price ratios have higher insider holdings, we draw a sample of 350 stocks from *Value Line Investment Survey* beginning with the March 22, 1991, issue and continuing sequentially through subsequent editions. We

¹⁰ However, in the return dummy variable regressions (Panel B), there is no clear tendency for insider buys to be more strongly related to past 12-month or 36-month returns. The adjusted R^2 declines from 0.028 to 0.026 for the CF/P sample when the return period is extended. On the other hand, R^2 rises from 0.016 to 0.034 in the BV/P sample when the return period is extended.

Table IV
Regressions Explaining the Proportion of Insider Buys by Book Value to Price (BV/P) Deciles and 36-Month Returns, 1978–1991

The dependent variable in the three regressions in Panels A, B, and C is the number of open market purchases by all insiders in a firm divided by the total number of open-market purchase and sale transactions for each firm-year in the sample. The Annual Compustat Industrial tape over the years 1978 to 1991 is the source of book value data. Book value is Compustat Item 60. The book value for year t is divided by the market value of equity at the end of May in year $t + 1$, to produce Book Value/Price or BV/P ratio. Market value of equity is the product of the number of shares outstanding and the end-of-May stock price, both of which we obtain from the Center for Research on Security Prices (CRSP) Monthly NYSE–AMEX files. We find the insider trading transactions of the companies in the decile BV/P and three return portfolios using data compiled by the Securities and Exchange Commission (SEC) and available on several tapes from the National Archives and Records Administration. We restrict the transactions to open-market purchases and sales. Option related and other transactions are ignored. We count open-market purchases and sales in the February–May test period of each year. The independent variables in Panels A and C include the BV/P decile dummy variables, where the variable equals one if it is in that decile and zero otherwise. Decile BV/P 1 has the lowest BV/P values and decile BV/P 10 has the highest. For each 36 months ending in May of each year, we find the buy-and-hold return of any firm that has insider open-market insider transactions. The returns are pooled over all years and divided into three categories: High, Medium, and Low returns. The return variables in Panels B and C include the return dummy variables, labeled High for the highest prior 36 months' buy-and-hold return and Medium for the middle values of the prior 36 months' return. The table shows coefficient estimates and test statistics for the regressions estimated over all firm-years for the period 1978 to 1991. The intercept of the regression in Panel A estimates the proportion of insider buys for the highest BV/P category; in Panel B it estimates the proportion of insider buys for the lowest return category; and in Panel C it estimates the proportion of insider buys for the highest BV/P and lowest return category.

Variables	Coefficients	t-Statistics	p-Values
Panel A: Book Value Dummy Variable Regression; adjusted $R^2 = 0.053$			
Intercept	0.576	29.80	0.0001
BV/P 1	-0.331	-13.92	0.0001
BV/P 2	-0.311	-13.46	0.0001
BV/P 3	-0.275	-11.94	0.0001
BV/P 4	-0.193	-8.23	0.0001
BV/P 5	-0.208	-9.01	0.0001
BV/P 6	-0.132	-5.40	0.0001
BV/P 7	-0.094	-3.84	0.0001
BV/P 8	-0.064	-2.62	0.0089
BV/P 9	-0.068	-2.77	0.0056
Panel B: Return Dummy Variable Regression; adjusted $R^2 = 0.034$			
Intercept	0.484	60.06	0.0001
High return	-0.195	-17.87	0.0001
Medium return	-0.073	-6.39	0.0001
Panel C: Book Value and Return Dummy Variable Regression; adjusted $R^2 = 0.071$			
Intercept	0.617	31.46	0.0001
High return	-0.146	-13.21	0.0001
Medium return	-0.054	-4.78	0.0001

Table IV—Continued

Variables	Coefficients	t-Statistics	p-Values
Panel C: <i>continued</i>			
BV/P 1	-0.278	-11.62	0.0001
BV/P 2	-0.264	-11.37	0.0001
BV/P 3	-0.237	-10.30	0.0001
BV/P 4	-0.158	-6.79	0.0001
BV/P 5	-0.171	-7.39	0.0001
BV/P 6	-0.108	-4.44	0.0001
BV/P 7	-0.074	-3.05	0.0023
BV/P 8	-0.047	-1.94	0.0529
BV/P 9	-0.059	-2.39	0.0167

take every stock for which insider holdings are reported and for which cash flows are nonnegative. Stocks failing to have insider data include foreign issues and investment companies. *Value Line* does not have cash flow data for banks and insurance companies. With these exceptions, the sample contains a very broad range of industrial, retail, transportation, utility, and other concerns. We use the latest price reported and the most recent year-end cash flow per share reported to compute the cash flow to price ratio.

Table V shows the mean cash flow to price ratio and the mean percentage of insider holdings in deciles of cash flow to price ratio. Relatively high mean values of insider holdings occur in deciles 1, 2, and 4 of cash flow to price. However, a low value occurs in decile 3. To test for a relation, we regress *Inside*, the percentage of insider holdings, against *CFP*, the ratio of cash flow to price:

$$\begin{aligned} \text{Inside} = 16.05 - 8.81 \text{ CFP} \quad (R^2 = 0.0019) \\ (10.61) (-1.16) \end{aligned} \tag{1}$$

Overall, there is no relation between insider holdings and cash flow to price ratio. However, we undertake two additional tests of the holdings hypothesis.

We first examine the relation between *changes* in insider buying behavior and *changes* in a company's growth/value decile rankings. Suppose that for a given company, there is a change in CF/P ranks. Are larger changes in CF/P ranks accompanied by larger changes in insider buying? Such a relation, if it exists, would present difficulties for the holdings hypothesis, for, although insiders make many buy and sell trades, their overall levels of insider holdings are relatively stable over time. That is, their trading does not typically disturb the bulk of their holdings.¹¹

¹¹ Inspection of insider holding percentages in *Value Line* for given firms over several years makes this evident.

Table V**Mean Percent Insider Holdings in Deciles of Cash Flow to Price**

We select the first 350 stocks from *Value Line Investment Survey* beginning with the March 22, 1991, issue and continuing sequentially through subsequent editions. We take every stock for which *Value Line* reports insider holdings and for which cash flows are nonnegative. We use the latest price reported and the most recent year-end cash flow per share reported to compute the cash flow to price ratio. The data are sorted by cash flow to price ratio. The table reports mean values within the deciles.

Decile	1	2	3	4	5
Cash flow to price	0.0401	0.0621	0.0801	0.0996	0.1436
Percent insider holdings	17.69	22.49	13.41	19.99	13.62
Decile	6	7	8	9	10
Cash flow to price	0.1436	0.1637	0.1912	0.2290	0.4401
Percent insider holdings	8.86	14.40	11.44	12.33	12.38

We therefore examine the relation between changes in the proportion of buys and changes in CF/P ranks. For each firm we find all available changes in buy proportions, $DBuy$, and the corresponding changes in CF/P rank, $DRank$. Where there are missing firm-year observations, we compute changes across more than one year. We then regress $DBuy$ against $DRank$ across all observations for all firms:

$$DBuy = -0.0011 + 0.0158 DRank \quad (R^2 = 0.0051) \quad (2)$$

(−0.167) (5.67)

Changes in insider buying rise significantly with increases in CF/P rank. The larger the increase in the rank, the larger the increase in the insider buying proportion. Our estimate of the difference between decile 1's and decile 10's proportion of buys is 0.142. In Panel A of Table III, the estimated difference was 0.22. Indeed, because the estimates are reasonably near those of the dummy variable regression, the overreaction hypothesis is supported.¹²

Secondly, we reexamine the dummy variable regressions after eliminating deciles 1 and 2 of CF/P. Because insider holdings are higher in deciles 1 and 2 of CF/P, we eliminate these two deciles as a robustness test. The results, whether using CF/P or BV/P, are very similar to those previously presented; hence, we do not present them. In the regression corresponding to Panel C of Table IV, for example, which uses 36-month returns and BV/P deciles, elimination of deciles 1 and 2 still results in a highly significant regression with all of the remaining deciles still highly significant. The adjusted R^2 is 0.051 and coefficients at deciles 3 through 6 are significant at the 0.0001 level.

¹² The analogous regression using BV/P ranks is likewise significant and has a somewhat higher adjusted R^2 .

Even decile 9's coefficient is significantly lower than decile 10's at the 0.02 level.

These tests show that, even if the holdings hypothesis has some appeal, the data consistently reject the random hypothesis and strongly support the overreaction hypothesis. Further, the holdings hypothesis cannot explain the changes regression.

IV. Summary and Conclusions

The proportion of buy transactions in insider trades is positively related to the ratio of cash flow to price (as well as book value to price) and negatively related to prior stock return. The evidence is consistent with the hypothesis that outside investors overvalue growth stocks and undervalue value stocks. Insider transactions are consistent with a well-informed contrarian approach to stock investing.

There are three alternative interpretations of the findings. One argument is that insiders sell on price advances as a matter of portfolio diversification because as prices rise more and more of their wealth is tied up in a single issue. We control for this effect by incorporating prior stock returns in the models. The growth/value effect on insider trades is significant after controlling for prior return behavior. Furthermore, the regression evidence suggests that the interaction between the two effects is limited.

A second argument is that there is more selling in growth stocks because insiders hold a greater fraction of these stocks. We find that this hypothesis does not explain changes in insider buying as growth/value deciles change. Also, relations of insider trading to growth/value deciles remain significant after removing several deciles in which insider holdings are high.

A third possibility is that rational risk factors are responsible for the observed relation. According to the Fama–French model, high CF/P stocks are exposed to a risk factor. Hence, under this model, our findings mean that corporate insiders rationally prefer to sell the less risky growth stocks and buy the more risky value stocks. However, because there are no theoretical grounds for such insider behavior, we find this interpretation implausible.

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